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ABSTRACT

A feasibility and planning study was conducted on braille code problems in five areas. The areas were textbook format, math and science, music notation, computer notation, and maps, charts, and diagrams. Problems in each of the areas were identified and defined by committees of experts. The problems were analysed and a determination was made of the methodology and amount of time required for their resolution. From the analyses it was concluded that a massive, short-term research assault on all of the problems was not feasible. However, a large number of problems were found which could be resolved within three to four years. The basic strategy for resolving these problems was group judgment or consensus. The number of persons needed for the effort was three to four. An application for a grant to study the problems was prepared. (Author)

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Braille Codes Pilot Project

1 December 1970 - 31 January 1972

Final Report

Grant No. 14-P-55094/4-01

Cleves J. Kederis and Carson Y. Nolan
American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

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Foreword

Much work needs to be done on problems within the braille codes for the blind person to fully realize his capabilities and potential. To this end the Braille Authority has worked tirelessly over the years. The Braille Authority is a group of persons distinguished in their knowledge of braille whose function, briefly, has been optimization of the use of the braille codes. A number of things, among them, the organization of the Authority, the part-time nature of its work, the shortage of financial resources, and the nature and magnitude of some of the problems have prevented this body from completely fulfilling its objective. As a consequence, this group initiated efforts to overcome this inadequate state of affairs and attack braille problems on a much larger scale. These efforts resulted in the present project. To obtain funds for the project the Braille Authority provided the background information and expertise, and Dr. Berthold Lowenfeld, chairman of the Advisory Council of the Braille Authority, prepared the application.

Not only was the work of the Braille Authority useful to the initiation of this project; it was also beneficial to the conduct of the investigation. In its efforts prior to the acquisition of this grant, the Braille Authority prepared an Outline of Research Needs for Improvement of the Braille Codes. This document covered a history of its work and a specification of important general problem types which confronted the Authority over the years. Because of the Authority's expertise and experience with the code problems, it seemed only reasonable that its work should assume a central part in the present project. As such, it constituted most of the introduction of this report, and, during the conduct of the investigation, it served as a very useful guide.

From the foregoing the impression should have been obtained that the present work was something more than an individual effort. It was. In its truest sense it was a group effort. As a group effort, it is difficult to express adequately appreciation to all of the persons who contributed and who were so very helpful to the study. But difficulty does not prevent the attempt. Sincere thanks are extended to the Braille Authority and its Advisory Council, to all of the working committees of the project, to those consulted who are too numerable to name, and to those who had to share the burden placed on the consultants and participants.

In saying that the project was a total group effort, it is not intended that the consultants should share any of the inadequacies of the study. Those who contributed were generous and knowledgeable in supplying the information requested of them. Any deficiencies or shortcomings in the outcome of the study are the sole responsibility of the authors.

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Purpose

The purpose of this study was to explore the feasibility of a massive research program which would provide a coordinated solution to braille code problems in the areas of textbook formats and techniques; mathematics and science; music notation; computer notation; and maps, charts, and diagrams. Correlative to this objective, plans were to be made for future resolution of the problems. Planning was to take the form of determining the research strategy and amount of time needed to resolve the problems. An outcome of the study was to be a grant proposal for future work on the codes problems.

Background

The history of tactual codes for the use of blind people in the United States is replete with numerous attempts to arrive at a reading system which would adequately present literature and technical material in a manner intelligible through the medium of touch. During the first 90 of the past 140 years, various educators for the blind advocated specific reading systems which varied from dot representations to raised ink-print letters. Some of the early systems used by individual schools and publishing houses for their own clientele of readers included Boston Line Letter, New York Point, Moon Type, American Braille, and Revised Braille Grade 1 1/2, which made published literature unavailable to those who were not trained in more than one embossed system. As a result of international conferences of representatives of English-speaking countries, the present basic system, Grade 2 Braille, was standardized in 1932. This system was based on the music notation and alphabet devised by Louis Braille and contained 185 contracted literary forms introduced into the system to accelerate reading.

In 1950, the American Association of Workers for the Blind(AAWB) and the Association for the Education of the Visually Handicapped (AEVH), then the American Association of Instructors of the Blind (AAIB), established a committee of braille experts to review the effectiveness of all braille codes in order to update them and to assure their adequacy in providing the media for the production of general literature, music, and technical materials. This committee, and its successors, have been organized on a voluntary basis with exceedingly limited funding provided by the two Associations.

The Braille Authority has produced several standard rule books to meet the specialized needs for embossing various types of ink-print representations. These include:

ENGLISH BRAILLE, AMERICAN EDITION 1959; Revised, 1962, 1966, 1968, 1970

THE CODE OF BRAILLE TEXTBOOK FORMATS AND TECHNIQUES, 1965; Revised, 1966, 1970

THE NEMETH CODE OF BRAILLE MATHEMATICS AND SCIENTIFIC NOTATION, 1952; Revised, 1965, 1972

THE REVISED INTERNATIONAL MANUAL OF BRAILLE MUSIC NOTATION, 1956

As these code books were given widespread use by braille publishers and educators of the blind, their effectiveness and value became readily evident. Prior to their development, only sparse amounts of technical material could be made available in embossed form, which resulted in limiting the education of blind people. As a specific example, some universities waived courses in mathematics and science for blind students who could not meet basic requirements because of the lack of adequate texts or embossed notations comparable to those being used by fellow students. As a result of the development of techniques for technical representation, even though substantially inadequate, parallel textbooks were made feasible, and the education of blind people expanded from the limitations of the residential schools for the blind to integration into community public school systems. This broadening of educational horizons has substantially expanded vocational opportunities for blind people in many areas, such as computer programming, social service, engineering, and teaching in mathematics, music, and the sciences generally.

In attempting to provide efficient and comprehensive braille codes for the various disciplines, the Braille Authority gathered together advisory committees of specialists and experts whose combined experience and knowledge have aided in producing needed symbols and techniques. Each code has required revision from time to time as information has been obtained by questions from educators and braille transcribers who were confronted with specific items not covered in published codes. No facilities or staff have, to date, been available to the Authority for systematic examination of all types of copy in order to search out and locate symbols and formats used by ink-print publishers. If braille codes are to be fully implemented, it is essential that researchers in all aspects of code development have an inventory of ink-print representations in order to provide for all possible braille code requirements. In addition, major work is yet necessary in the psychophysical investigation of tactile patterns, such as line, texture, and figure size, and so on.

With the passage of time, educators and braille publishers have been brought to the realization that volunteer braille committees, at their concentrated yet infrequent meetings, could not cope with all of the problems which occur in ink-print publications and represent them adequately in braille notation. In order to ensure equal educational and full vocational opportunities for blind people, it has become evident that a concentrated effort by braille specialists and experts must be undertaken. At the present rate of development, it is obvious that many years will pass before fully effective codes can be achieved under the existing method of operation. Therefore, the Braille Authority and its Advisory Council of 12 national representatives of workers for the blind are in agreement that complete braille code development can only be accomplished by definitive research on a full-time, paid basis, within a reasonable period of time. The following material describes the unfinished and gray areas of all of the specialized braille codes.

Needs in Specific Areas

Code of textbook formats and techniques The great variety of transcription problems which occurs in textbook embossing have challenged the initiative of volunteer transcribers and braille publishers for many years and have resulted in techniques which likewise challenge the ability of the braille reader to comprehend the symbolism and rules of usage being followed. In 1965, the Braille Authority and its Textbook Advisory Committee offered the first manual of techniques and format which has aided, to some extent, the standardization of presentation of this type of material. In furnishing this guidance, the drafters were well aware that the material therein barely scratched the surface of the wide range of problems to be encountered in attempting an equivalent braille transcription of the many symbols and formats used in ink-print texts.

Educators of blind children, youth, and adults have continued to pressure for a more inclusive and adequate manual of formats and techniques in order to give the blind student the equivalent information that his sighted peers receive. The problems have been compounded by the fact that authors and ink-print publishers have introduced visual techniques, such as the use of color, change of type, underscoring, etc., to point up differences in thought and emphasis. Additionally, the breadth and length of the ink-print page, as well as the size of type, provides ink-print publishers with a wide latitude of format, whereas the limitations of the braille page and the six-dot braille system necessitate readjustment and realignment of copy in order to make the presentation intelligible to the touch reader. Therefore, problems of formats, diagrams, and tabulation require considerable research to make such material usable in embossed form.

One of the major problems in dealing with formats is that, to date, it has not been possible to locate and identify all of the various types of usages which ink-print publishers employ. The problem is compounded by the fact that ink-print publishers themselves do not employ standard symbols for equivalent material. It is, therefore, essential that research be undertaken with regard to the practices of ink-print publishers in order that provision can be made for all ink-print symbols now in use.

As a result of the material already provided in the CODE OF TEXTBOOK FORMATS AND TECHNIQUES, ample evidence is at hand to insure that, with adequate funds and research personnel available, the blind student can be given the facilities to meet his educational demands on an equal basis with his sighted peers.

Maps, charts, and diagrams A review of current procedures and resulting products of braille paper maps, diagrams, and charts shows that there have been no changes or improvements since the early 1930's, with the possible exception of employment of the vacuum-forming process, which can take advantage of other techniques not practical for the two-dimensional limitations of paper reproduction. Further, no basic research on the psychophysical problems of the braille reader has been undertaken except on a very limited scale (see Nolan & Morris, 1971). The problems in this field are, therefore, in need of an unusually large amount of research, covering not only

the psychophysical aspects, but the determination of legible symbols and usages, and the development of the tools to make such maps, charts, and diagrams--both by the hand transcriber who works directly on paper and the publisher of multiple-copy materials who must work on the same metal sheet used for embossing braille books. The problems are further aggravated by the fact that, not only is there no standardization of symbols used, nor tools to make them, but no attempt has been made in the educational field to develop adequate procedures for teaching the reading of braille maps, charts, and diagrams. Any research undertaken, therefore, must include not only the development of braille symbols (including dot and line sizes and kinds) and the creation of the tools to make them, but the development of procedures for teaching the reading of such materials to the blind student and the finding of some way of having such information included in the curricula of colleges and universities conducting special education courses for teachers of the blind.

Music. The esthetic and economic value of music in broadening the cultural life and in providing employment opportunities for blind people is axiomatic. THE REVISED INTERNATIONAL MANUAL OF BRAILLE MUSIC NOTATION, 1956, offers the basis for a workable, yet far from complete, system of notation which meets the minimal needs of the music student and performer. Provision already exists for vocal and instrumental notation which, in general, is systematically adequate. However, gaps still exist for the presentation of more complex scores and performing techniques, such as for liturgical music (Gregorian and Anglican chants), the tonic sol-fa notation, and certain percussion, string, and wind instruments, not to mention the growing number of electronic devices being used in modern music.

The existing music code provides for optional techniques in presenting many musical passages which leads to the confusion of the transcriber as well as interpretation by the performer. This confusion has resulted in a diminishing number of volunteer music transcribers, and the almost impossible problem of developing a computer program for braille music embossing. Through research, it is hoped that many of the vagaries and inconsistencies can be eliminated, and thus make music scores more intelligible to students, performers, and transcribers.

Serious study must also be undertaken to compare music presentations by various ink-print publishers in order to coordinate and correlate all techniques in common or unusual use.

Mathematics and scientific notation. The importance of a knowledge of mathematics in the education of blind people is increasingly evident in view of the many opportunities for employment which such knowledge can provide. Blind men and women are presently finding open doors in the fields of mathematics instruction, tax advising, actuarial work, computer programming, engineering, and the hard sciences, all of which have been made possible through the availability of appropriate mathematics symbolisms and techniques. The current mathematics code is but a foundation to the broad range of mathematics and scientific notation which is required to handle common usages and new symbols and formats in the developing world of scientific endeavor. To ensure that the mathematics code is fully adequate and current, it is essential that a wide investigation of all applicable fields be made by research teams

to the end that vocational opportunities can be made available in every scientific field. Although almost all of the symbols currently being used in science and mathematics are provided for in the current Nemeth Code, additional symbols will be required for those used in the developing sciences. Much research is yet required to find the most effective techniques for the presentation of certain ink-print formats; algorithms, tabular material, and the like. Additionally, information is yet barely provided concerning the presentation of statistics and logic.

Computer notation. Since symbols and formats for computer codes vary to some degree from usual mathematical presentation, it is essential that a special team of researchers be engaged in seeking out and developing the necessary braille code for this discipline. Such items as flow charts and punchcard information require attention. Additionally, it is essential that coding systems for developing hardware and software be provided to keep manuals up-to-date.

Procedure

To fulfill the purposes of the study, information was needed about the number and types of existing braille problems and the methodology and time periods required to resolve the problems. In order to acquire this information, it was necessary to identify and define as many of the problems as possible. To accomplish this committees of experts were formed for each of the five areas of interest. Subsequent to their work the project staff analysed the problems and determined the methods and the amount of resolution time required. A final review group made up of the Braille Authority and its Advisory Council evaluated the work of the project staff. Their conclusions provided the basis for the final wrap-up of the study.

The composition of each of the working committees in each of the five areas was based on a number of criteria. (1) All had to be knowledgeable in braille and their respective areas. (2) One or more had to be teachers. (3) One or more had to be a volunteer transcriber. (4) One was to be employed by a publishing house. And (5), where possible, all were to be members of the Braille Authority Advisory committees. Selection of the committee personnel was done with the aid of recommendations from members of the Braille Authority and other accomplished persons in the area of the visually handicapped. Final membership on a committee depended on the number of the candidate's recommendations and his willingness to serve on an unpaid basis. A listing of the members of each comittee can be found in Appendix A.

There were two, two-day meetings of each of the working committees in each of the areas. The two meetings in each of the areas were separated by approximately two and one-half months. During the first meeting the committees identified and discussed braille code problems about which they were knowledgeable. Afterward the investigator refined and classified the problems by type. Prior to the second meeting this refined list of the problems was sent to the members of the appropriate committees. At the second meeting, the committees reviewed and evaluated the work-up of the

investigator and modified and expanded the materials where necessary. Following this meeting, the problem lists were revised to conform to the changes and additions suggested by the committees.

Next, the individual lists were evaluated to determine similar kinds of problems common to all the areas, and all of the problems were brought together in a generalized list. Using the generalized list, analyses were made of the different types of problems and of the kinds of research work necessary to resolve the problems. Two reviewers independently performed this latter activity. A tabulation of these results provided the bases for the preliminary conclusions of the study. The generalized problem list and the conclusions were sent to the review committee for its evaluation. The review committee was composed of the Braille Authority and its Advisory Council. A listing of the members of these groups appears in Appendix B. A two-day meeting of these groups was held to discuss the results and preliminary conclusions of the study. Subsequent to the meeting, a report of its proceedings was written and further analyses suggested by the review groups were made of the data.

Results

The results section, while not presented in two separate parts, was in fact developed at two different times and under different conditions. The first part consisted of the first two tables of data and provided the bases for the preliminary conclusions of the project. The second part consisted of the remaining tables of data and was the result of analyses requested by the Advisory Committee. These data were the bases for the final conclusions. Basically, the two parts differ in degree of differentiation and reflectance on future work. The second part is the more specific and is concerned with the details of follow-up work.

The basic results consisted of five lists of problems which were identified by the five working committees. The problems generated by the committees were analysed and it was found that, with the exception of the maps, charts, and diagrams area, they were classifiable under one of five headings: (1) general considerations, (2) problems of symbology, (3) problems of format, (4) problems of displays, and (5) factors needing development. A sixth class of information, resources, was added to some of the areas where it appeared useful to follow-up work. The maps, charts, and diagrams problems were of slightly different types. All of these problems can be found listed by areas in Appendix C.

A second kind of analysis necessary to judgments of feasibility and subsequent work on the codes consisted of relating the problems across areas. This meant bringing together the same kinds of problems from all of the areas. The outcome of this endeavor was a more complete and refined classification of a generalized list of problems. This generalized list can be found in Appendix D.

A gross analysis of the problems identified the kinds of approaches needed to resolve them. Three categories of problems were found: (1) problems that could be resolved by expert group consensus or judgment (GJ), (2) problems

involving experimental or empirical research (ER), and (3) problems involving code development (CD). This evaluation led to a third kind of results consisting of identification of the strategies for resolving the problems and estimates of the time required to implement the strategies. The remainder of the results section will concern these data.

Two persons independently evaluated the problems for methodologies and time estimates. The basic methods for which the problems were evaluated were those found above and their combinations. The time estimates were (1) short-term activity of less than three years or (2) long-term activity of more than three years. The degree of agreement between the two reviewers was approximately 90% or the equivalent of a .95 correlation.

One of the reviewers in his evaluation elaborated the methods to include literature analysis (LA), which was either a review of print or braille literature or a frequency count of some of the elements of the language, and an attitude or opinion survey (OS). Because of its greater differentiation this analysis was the one used for reduction of the data in tables 1 and 2. The item analysis by the two reviewers can be found in Appendix E.

Table 1 shows a frequency count of the methods and time estimates for the different types of problems. The entries and total number represent individual problems from four of the areas, excluding the maps, charts, and diagrams area. This category was excluded because the problems were mainly of a perceptual nature requiring basic research over a long duration. The total number of these perceptual problems was approximately 160.

The entries in Table 1 show there were 678 problems in all. Again, this is exclusive of the non-linear display problems which, in terms of experimental efforts, would undoubtedly exceed that required by the problems listed. With regard to the total number, the figure should be considered only as approximate because a number of the items contained more than one problem or consideration.

In terms of types of problems, the linear display category contained the most, approximately 31%. The second most frequent was formats for page variations with 21%. Following this were the general considerations with 18%. The next most numerous, at 13% , were the problems of symbols and rules. The other three categories, factors needing development, formats for language and special materials, and formats for parts of book, made up the remaining 17%.

In terms of the methodology or approaches for resolving the problems, data in Table 1 were combined and placed in Table 2. The data were combined to indicate better the basic methods and times estimates which reflect on the nature and direction of the work required.

Table 1

Approaches and Time Estimates for Resolving the Generalized Problem Items from the Standpoint of Their Occurrence in All of the Areas

Problem Types	GJ		GJER		GJOS		GJLA		GJCD		ER		ERLA		EROS		CD		Totals
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
General considerations	66	8	12	2	6		14		2		1	12	1					1	125
Problems of symbols and rules	39		12	2	5		12		9		11								90
Formats for parts of book	7		5		2		1				1				2				18
Formats for page variations	29		46		5		36				13		8		5				142
Formats for language and special material	27		6		2		8				1								44
Linear displays	22		87	8	3		17				38	9	23		2				209
Factors needing development	27		2	1	1			1	6		3							9	50
Totals	217	8	170	13	24	-	88	1	17	-	68	21	32	-	9	-	-	10	678

Table 2

Combined Approaches and Time Estimates for Resolving the Problems in All of the Areas

Problem Types	GJ 1	GJ 2	GJ+ 1	GJ+ 2	ER+ 1	ER+ 2	CD 1	CD 2	Totals
General considerations	66	8	32	2	2	12	2	1	125
Problems of symbols and rules	39		29	2	11		9		90
Formats for parts of book	7		8		3				18
Formats for page variations	29		87		26				142
Formats for language and special material	27		16		1				44
Linear displays	22		107	8	63	9			209
Factors needing development	27		3	2	3		6	9	50
Totals	217	8	282	14	109	21	17	10	678

Table 2 showed that the proportional distribution of short- and long-term efforts varied considerably among the approaches and problem types. A cursory addition of the totals for the approaches indicated that more than 600 required short-term efforts. The method which occurred with the greatest frequency, 44% was the combination group judgment plus other research-like activities. This category along with the straight group judgment category contained 77% of the problems. Of this 77% only 4% require long-term solutions. The third most numerous category was experimental research with 19% of the problems, of which 16% were long-term. Code development made-up the remaining 4% of the problems. Thirty-seven percent of these were long-term.

The preceding two tables of data formed the basis for the preliminary conclusions which were reviewed by the Braille Authority and its Advisory Council. These groups recommended that other counts and analyses be made of the data. The tables and data which follow are an implementation of this recommendation.

One of the items requested by the groups was a count of the actual number of separate problems contained in the generalized list of problems across areas. This number was 455 as contrasted with the 678 individual problems in all of the areas. Table 3 shows the total number of problems agreed upon by the two reviewers, 409. This number divided by the total, 455, gave the 90% agreement between the two reviewers. Except for the fewer number of problems, this table is similar to Table 1. Moreover, it reflects essentially the same information as the earlier table.

Another kind of analysis wanted by the groups was a more definitive breakdown of the short-term, group judgment problems. The breakdown was to contain data useful in determining the duration of approaches and problem priorities.

Table 4 presents these data classified by areas and types of problems. It showed that the textbook format area contained 46% of the problems, the music area 29%, and the math area 20%. The remaining 5% were found in the computer and map areas.

Concerning the types of problems, the data indicated the following. Most of the general considerations problems were, in fact, non-specific to the individual areas. An examination of these problems showed they were mostly matters of policy and philosophy of transcription. Among the other types of problems, excepting formats for parts of book, the frequency of occurrence was fairly uniform. The problems, formats for parts of book, occurred with much less frequency than the other types. Two of the problem types, formats for parts of book and formats for language and special materials, occurred only within the textbook format area.

Table 5 presents a more precise breakdown of the time required to solve the different types of short-term, group judgment problems. The data were fairly straightforward and showed that 82% of the problems could be resolved in one year or less, 14% could be resolved in one to two years, and only 4% required two to three years.

Table 6 presents a more refined breakdown of the time required to resolve the short-term, group judgment problems which required additional work. As in Table 5 most of the problems, 79%, could be resolved in one year or less, 14% in one to two years, and 7% in two to three years. Table 6 also shows that the problem types, problems of symbols and rules, formats for parts of book, formats for page variations, and formats for language and special materials, require, almost exclusively, only one year or less to resolve.

Table 3

Approaches and Time Estimates Agreed Upon by Two Reviewers for Resolving the Separate Generalized Problem Items

Problem Types	GJ		GJER		GJOS		GJLA		GJCD		ER		ERLA		EROS		CD		Totals
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
General considerations	35	7	9	10	7		9	1	3	1		12						2	96
Problems of symbols and rules	13		5	1	1		8	1				2							31
Formats for parts of book	7		4		2		1				1				2				17
Formats for page variations	25		26		4		21				7		2		4				89
Formats for language and special material	22		6		2		6			1									37
Linear displays	18	1	50	6	2		5	1			7	5	3		1				99
Factors needing development	26		1	2	1				5	1	3							1	40
Totals	146	8	101	19	19		50	3	8	3	18	19	5		7			3	409

Table 4

Short-Term, Group Judgment Problems Agreed Upon by Both Reviewers Which Show the Relationships between the Separate Generalized Problems and Their Referents in the Five Areas

Problem Types	No. Separate Problems	Areas					Total Problems in Five Areas
		TF	Math	Music	Comp	Maps	
General considerations	35*	1	3	6	4	1	15
Problems of symbols and rules	13	9	7	10	2		28
Formats for parts of book	7	7					7
Formats for page variations	25	16	6	6	1		29
Formats for language and special material	22	22					22
Linear displays	18	11	13				24
Factors needing development	26	4	1	22			27
Totals	146	70	30	44	7	1	152

* Mostly matters of policy

Table 5

Refined Resolution-Time Classification of the Short-Term, Group Judgment Problems

Problem Types	Time		
	One Year or Less	One to Two Years	Two to Three Years
General considerations	27*	4	4
Problems of symbols and rules	10	3	
Formats for parts of book	5	2	
Formats for page variations	22	2	1
Formats for language and special materials	22		
Linear displays	16	2	
Factors needing development	18	7	1
Totals	120	20	6

* Mostly matters of policy

Table 6

Refined Resolution-Time Classification of the Short-Term Group Judgment Problems Which Require Additional Work

Problem Types	GJER			GJLA			GJOS			GJCD			Totals
Years	1	2	3	1	2	3	1	2	3	1	2	3	
General considerations	4	4	1	6	2	1	5		2	1	2		28
Problems of symbols and rules	4		1	7	1		1						14
Formats for parts of book	4			1			2						7
Formats for page variations	25		1	21			4						51
Formats for language and special materials	5	1		5	1		2						14
Linear displays	40	8	2	2	2	1	1	1					57
Factors needing development	1						1			4	1		7
Totals	83	13	5	42	6	2	16	1	2	5	3		178

In order to make these times meaningful in terms of manpower needed, the data in tables 5 and 6 were further evaluated for number of man-years required. This analysis assumed that the necessary manpower would be assisted by groups of persons expert in the problems being considered. For the data in Table 5 it was decided that all of the one year or less problems could be resolved by one person in one year. The other problems in that table would take one person approximately three years. From Table 6, figuring six weeks for each of the one year GJER items and four weeks for each of the one year GJLA items resulted in approximately 10 and 3 man-years, respectively. The other items in these categories and in the two other categories, GJOS and GJCD, would require one person three years for each kind. The total figures for each of the different types of problems can be found in Table 7. Altogether they amounted to 29 man-years.

Because the large number of short-term problems required such an extensive amount of work, priorities for attacking the problems were needed.

Table 7

Number of Man-Years Required by the Different Short-Term, Group Judgment Problems

GJ	GJER	GJLA	GJOS	GJCD	Total
4	13	6	3	3	29

Priorities needed to be established for the solution of the greatest number of problems within the shortest period of time. An examination of the tables indicated this objective could be realized by selecting the problems which (1) involved group judgment, (2) appeared in the fewest number of areas, (3) involved the least number of approaches and (4) required the fewer number of long-term efforts. Four types of problems appeared to fit these criteria. Their presentation order indicates the order in which they should be studied.

a) Formats for Language and Special Materials
b) Formats for Parts of Book
c) Problems of Symbols and Rules
d) Formats for Page Variations

In order to determine the amount of time required to resolve only these four types of problems, Table 8 was prepared. This table is merely an amalgam of the data on the four types of problems found in previous tables.

It shows the four types of problems classified by methodology and refined solution times. In all there were 151 problems. Forty-three percent were GJ, 26% were GJER, 24% were GJLA, and 6% were GJOS. There were no GJCD problems. Ninety-two percent of all the problems could be resolved in one year or less given the sufficient manpower.

To determine the manpower needs for these data calculations similar to those performed for Table 7 were made. The calculations indicated the one year GJER problems would require four and one-half man-years, and the one year GJLA problems would require approximately three and one-half years. All the rest of the problems would require around three man-years. The total for the four categories of problems was approximately 11 man-years.

Table 8

Resolution-Time Estimates for Four Categories of Problems

Problem Types	GJ			GJER			GJLA			GJOS			GJCD		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Formats for language and special materials	22			5	1		5	1		2					
Formats for parts of books	5	2		4			1			2					
Problems of symbols and rules	10	3		4		1	7	1		1					
Formats for page variations	22	2		25		1	21			4					
Totals	59	7		38	1	2	34	2		9					

Conclusions

The conclusions are described in three parts. The first part deals with the preliminary conclusions which were prepared for and reviewed in the final evaluation meeting. The second part is the report of the deliberations and conclusions of the evaluative groups. The third part contains conclusions based on further analyses suggested by the evaluative groups as well as other final considerations dictated by the study.

Preliminary Conclusions

These conclusions were derived from the generalized problem summary and the tabulated results. They were of three types: (1) those concerned with transcription policy and background, (2) those concerned with the results of the classification of methods and time, and (3) those concerned with future work on the codes.

Some of the conclusions were based on an examination of the items in the problem summary. One problem of considerable importance which arose in a number of the areas had to do with the development of an overall code which would embrace all the areas. It was suggested that characters used in such a code might be three dots high with a variable base, i.e., a character could be 2, 3, 4, or more dots wide. Such a system would permit thousands of symbols to be distinctly coded. This system will subsequently be called an integrated code. Obviously such a consideration would have far-reaching consequences, and the project staff needed guidance from the evaluative groups before making final conclusions.

The preliminary conclusions will be listed by number as they were for the evaluative committee.

1) There are some relatively basic issues and policy matters contained in the general considerations section of the report, e.g., inconsistencies and ambiguities within and across codes or the issue of isomorphism versus divergence. These issues need to be resolved at the very beginning of any future work on the codes.

2) Before any long-term research efforts are begun the question of whether or not to develop an integrated code should be resolved.

3) A massive, short-term (three-four years) research assault on all of the problems of the braille codes is not a feasible approach. For one reason, there are too many problems. For another, the study and solution of many problems is sequential in nature and must of consequence be spread over a number of years.

4) Because of the long-term, sequential nature of a large number of the problems, the code work must necessarily be of a developing character resulting in successive approximations to the most readable code. Furthermore, since language and new information are constantly evolving, code development and research will probably never cease.

5) There are a large number of problems that can be solved through expert discussion and agreement within a relatively short time. Work involving the judgment of groups of experts could be initiated immediately and with a sufficient number of personnel most of these problems could be resolved in approximately three years.

6) In order for any long-term research program to be initiated and successfully carried out, a responsible organization must be set up or identified from existing organizations.

Summary of the Review of the Project by the Sponsoring Groups

The conclusions listed on the previous pages were reviewed and their implications discussed at a joint meeting of the Braille Authority, its Advisory Council, and the project staff held at the American Printing House for the Blind (APH) on 20-21 January 1972. Those present were Mr. Bernard M. Krebs, Mrs. Maxine Dorf, Miss Marjorie S. Hooper, Mrs. F. J. Mann, of the Braille Authority; Dr. Berthold Lowenfeld, Dr. Natalie C. Barraga, Mr. Robert S. Bray, Dr. Charles E. Hallenbeck, Dr. Robert W. Mann, Miss Lorraine P. Murin, Dr. Abraham Nemeth, Dr. Carson Y. Nolan, Miss Josephine L. Taylor, of the Advisory Council; and Mr. Finis Davis, Vice President and General Manager of APH. The meeting started with a description of the procedures used in the study, a review of the findings, and of the conclusions drawn by the principal investigator. The principal investigator then presented the group with the following list of questions for possible discussion.

1. Are the conclusions warranted and do you agree with them?

2. If there is agreement, what should be done about resolution of the problems? Specifically,

   (a) Should the development of an integrated code be considered? Should a feasibility study of the integrated code be formulated?
   (b) What are the implications of studying the integrated code on the resolution of the short-term problems by groups of experts? Should a research program be developed for these short-term problems?

3. If a research program is set up for studying either or both the integrated code and the group judgment problems, what should be done about the following?

   (a) How should the program be organized and administered?
   (b) Over how long a period of time should the program extend?
   (c) How should the program be staffed?
   (d) Where should the staff and facilities be housed or located?
   (e) Who could sponsor or fund the program?
   (f) What role should be played by various organizations involved in work for the visually handicapped? Mr. M. Robert Barnett expressed interest in how the American Foundation for the Blind (AFB) could help or contribute to the project and future code work.

4. What further analysis should be done to the data?

5. Are there any other items of interest or concern in the problem summary, classification of methods, or the overall project which should be discussed?

Agreement with the conclusions. While there was considerable discussion and a number of questions raised concerning certain aspects of the conclusions, in general the group agreed with the project staffs' appraisal of the meaning of the results of the study. The project staff was requested to attempt a more detailed breakdown of the data than was available in Table 1. What the group wanted was an actual count of the problems in the generalized problem list and more definitive time estimates of the short-term problems. It was felt that this additional information would be quite valuable in the assignment of priorities and the estimation of future project costs.

Future research efforts. The group agreed that a broad scale research effort to resolve Braille problems should be mounted. Immediately, an intensive attack should be made on the short-term problems of the present codes that were judged solvable through group concensus. Concurrently, an attempt should be made to explore the possibilities for long-term development of an integrated code and to develop resources for research on the perceptual problems involved in non-linear tactile displays.

Overall stimulation and monitoring of the research. It was agreed that all research should take place under the umbrella of the Braille Authority and its Advisory Council since a continuing body was needed for this purpose. The possibility of combining the membership of both these groups into an American Braille Council (ABC) for this purpose was discussed. It was suggested that the National Braille Association might also be included in the ABC membership. It was agreed to explore the formation of the ABC with the sponsoring bodies of the Braille Authority, the AEVH, and the AAWB.

Development of an integrated code. The group discussed the potential of an effort to develop an integrated code which would cover all the areas; literary, mathematics, science, music, and computer notation. The latter specific codes would all be subsets of a whole. An integrated code would require that each construct be represented the same way in braille regardless of subject matter.

The group felt that development of an integrated code should be thoroughly explored. It was agreed that the most fruitful approach was use of a variable base cell, three dots high. If three columns were ultimately used this would yield 512 possible configurations, or if four columns were used, 4096 different configurations would be possible. The group was in agreement that an expanded code of this nature could retain most of the elements and meanings of the current literary code. The code should be compatible for computer translation.

The agreement of the group to pursue this investigation was made in full understanding of the many problems that would insue from a major code change. Problems discussed included the facts that all of the current codes, excepting the literary, would be rendered obsolete, current manuals would have to be rewritten, the braille consumer would be faced with the necessity for considerable relearning of codes, this country would be out of step with the rest of the world, and present writing devices and embossing equipment would have to be redesigned.

It was believed that some of the initial feasibility studies should concern cell legibility. It was pointed out that while an expandable cell offered greatly increased possibilities for diverse braille characters, it was not known at what degree of expansion perceptual problems might occur. Successful outcomes of the cell legibility studies would lead to work on the integrated code. This latter task was perceived as quite a long-term activity.

Sites for the feasibility studies were discussed. APH personnel expressed a low level of interest in this research. It was agreed that the best site might be a university based department of psychology. Discussion of possible sources of funding for these activities pointed up the severity of the problem of finding adequate funding for research of this nature under present conditions. Private organizations were considered the better possibilities.

Resolution of short-term problems by groups of experts. One major finding of the study was that there appeared to be a very large group of problems which could be resolved in a relatively short time through expert consensus. This is the traditional method of code development and definition followed by the Braille Authority through use of its subject matter oriented committees. The group was in agreement that efforts should be made to organize an intensive effort to solve these problems. Research funds should be sought to support a central site for such development and to pay expenses and honoraria to experts. It was felt this work should start immediately.

The present list of problems would need further breakdown and specification before this could occur. It was stressed that expert groups participating in the program should represent all braille users, young and old consumers, educators, volunteers, publishers, code experts, and subject matter experts. Where necessary group judgment should be validated through short-term perceptual research.

Site and organization for the short-term research. A number of possible sites for locating the short-term research effort were discussed. It was ultimately decided that this should be based at APH. This decision was strongly influenced by APH's role as the nation's official supplier of textbook braille, its continuous program of research, and its previous involvement in the solution of these kinds of problems.

It was suggested that APH write a proposal to obtain funding for the research. The general plan for the research was that it would consist of a strong intensification of the methods used by the Braille Authority

over the past decades in that groups of experts would be set up to deal with narrow problem areas. APH would provide a small staff to include a project director and assistants as well as space to house this staff and provide for small group meetings. The task would be to organize, schedule, monitor, and guide the small expert groups as they attacked problems in their areas. Outcomes would be assessed and integrated across code areas. Where necessary other APH research staff might provide short-term perceptual research support to validate small group decisions.

Funding of the short-term research. Among possible funding sources discussed were government agencies such as U. S. Office of Education, Library of Congress, National Eye Institute, and Social and Rehabilitation Service and private agencies such as the Seeing Eye Foundation and AFB. It was thought that APH's proposal should be initially submitted to Social and Rehabilitation Service for a three to four year project.

The need for intermediate funding to support the Braille Authority and its Advisory Council as well as any interim research they might conduct was raised. Dr. Lowenfeld and Mr. Bray agreed to approach the AFB in this regard with the Seeing Eye Foundation held as a possible alternate. These funds could also be used to finance activities of the ABC if brought into being. It was estimated that $20-24,000 would be required for one year of interim support.

Special legislation as a source of funding. The group explored the possibilities of attaining special federal legislation to provide funds for braille code research as well as research in other areas. In response to group queries, Mr. Davis of APH agreed that this was a distinct possibility, but strongly urged that such efforts do not interfere with administration of the present "Act to Promote the Education of the Blind." At the urging of the group, Mr. Davis agreed to explore the question of legislation with the Board of Trustees of APH and report the results of this exploration to Dr. Lowenfeld.

Research on non-linear displays. It was agreed that non-linear displays such as maps, charts, and diagrams present a special research problem. Little is known about basic processes involved in their perception. Knowledge of these processes is critical for development of improved designs which will be maximally legible. Research in this area must of necessity be long-term because the range of problems is broad and many solutions must be sequential in nature.

The group stongly urged increased research efforts in this area. Dr. Nolan and other group members reported their failure to interest university based psychologists and others in this research area. It was reported that APH had the only full time longitudinal program of this kind consisting of 1-5 persons. The group urged this effort be expanded.

The problem of funding basic tactile research was discussed. It was commented that requests for funding this kind of research often falls between "cracks" in the granting programs of federal agencies. Private agencies were suggested as the best source of funds for this purpose.

Final Conslusions

The final conclusions were principally concerned with the implementation of the recommendations of the advisory groups concerning future work on the short-term, group judgment and related problems. Specifically, the advisory groups recommended that immediate efforts be made to procure funds for resolving these problems. To do this, more information was required about problem priorities and estimates of time and personnel needed. Information relevant to these factors can be found in tables 4 through 8. Conclusions based on these data were the following

1) There were four categories of problems where work could be started immediately. They were:

   a) Formats for Language and Special Materials
   b) Formats for Parts of Book
   c) Problems of Symbols and Rules
   d) Formats for Page Variations

Their arrangement from top to bottom represents the order in which the problems should be attacked. Work on the other categories of problems would yield less immediate results. However, these other problems should not be ignored completely, but should be evaluated within the categories for priorities of individual items. This would be especially true of the general considerations category which contains matters of policy and philosophy of transcription which should be evaluated at the outset.

2) There were three areas where most of the short-term, group judgment problems were found -- textbook format, music, and mathematics. This was also true of the problems solvable by the other methods. Hence, future work should include a specialist from each of these areas.

3) It was estimated that work on the four categories of problems would require approximately 11 man-years. Using three people, one from each of the areas mentioned in item two, would mean that these problems could be resolved in approximately three and one-half years.

These conclusions will provide the bases for an application for funds to pursue the resolution of the problems which are short-term and have the more immediate payoff. This means the work begun in the Braille Codes Pilot Project could be continued without much loss of time. It does not mean that the other more long-term problems would be ignored. They simply require more resources and structure than what can be provided within a reasonable period of time. Moreover, if work is begun on the short-term problems, part of the efforts of those involved can be devoted to planning and seeking the resources necessary for the long-term problems.

One of the grave difficulties confronting work on the long-term problems is the absence of reliable information about the sense of touch or tactual perception. In the late 19th century Wilhelm Wundt studied the perception of dot configurations and determined that the braille cell was optimum in terms of number and form (Burklen, 1932). Since that time, over 100 years ago, very little additional information about the touch reading

process has accumulated which would permit principles and standards to be established for the production and reading of tactual materials. Thus, it cannot be expected that all of the problems of the braille codes are going to be resolved in a short time simply as a result of the application of a large amount of money. Needed are the interest and capabilities for doing tactual perceptual research.

Summary

A feasibility and planning study was conducted on braille code problems in five areas. The areas were textbook format, math and science, music notation, computer notation, and maps, charts, and diagrams. Problems in each of the areas were identified and defined by committees of experts. The problems were analysed and a determination was made of the methodology and amount of time required for their resolution. From the analyses it was concluded that a massive, short-term research asault on all of the problems was not feasible. However, a large number of problems were found which could be resolved within three to four years. The basic strategy for resolving these problems was group judgment or consensus. The number of persons needed for the effort was three to four. An application for a grant to study these problems was prepared.

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Appendix A

Members of Committees in Each of the Areas of Study

Textbook Format

Mrs. W. D. Earnest, Jr., Chairman, Foreign Language and Treasurer, NBA, New Jersey

Dr. George V. Gore, III, Professor Special Education, Michigan State University

Dr. Evelyn Rex, Professor Special Ed., Illinois State University

Mr. Fred Sinclair, Consultant in Education of the Visually Handicapped, California State Dept. of Education

Mrs. Theodore Stone, Member Braille Authority, Textbook Format Advisory Committee, Johanna Bureau for the Blind, Illinois

Music

Mr. George Bennette, Director, Lighthouse Music School, N. Y. Association for the Blind

Mrs. Janice Conard, Braille Music Advisor, Library of Congress

Mrs. Mary DeGarmo, Braille Music Transcriber, California Transcribers Association

Mrs. Hortense Foreman, Braille Music Teacher, Tennessee School for the Blind

Mr. Edward Jenkins, Chairman, Braille Authority Music Advisory Committee, Perkins School for the Blind

Mathematics/Science

Mr. Anthony Evancic, Math and Science Teacher, Western Pennsylvania School for Blind Children

Dr. Abraham Nemeth, Professor of Mathematics, University of Detroit

Mathematics/Science (Continued)

Mrs. Ruth Peters, Chairman, Area Representative, Math NBA, Ferndale, Michigan

Mrs. Helen Roberts, Member Braille Authority, Math Advisory Committee and Area Representative, NBA, New York

Mr. Don Wilson, Math and Science Teacher, Connecticut School for the Blind

Computer

Mr. Harry Bassler, Member Braille Authority Computer Advisory Committee, Colonial Penn Insurance Co., Philadelphia

Mr. Robert A. J. Gildea, Member Braille Authority Computer Advisory Committee, Mitre Corporation, Bedford, Massachusetts

Dr. Abraham Nemeth, Professor of Mathematics, University of Detroit

Mr. Bernard A. Perella, Member Braille Authority Computer Advisory Committee, Department of Defense, Washington, D. C.

Mrs. Ann Schack, Member Braille Authority Computer Advisory Committee, Department of Defense, Washington, D.C.

Maps, Charts, Graphs

Mrs. Betty Epstein Area Representative, Mathematics, NBA, Florida

Dr. Emerson Foulke, Director, Perceptual Alternatives Laboratory, University of Louisville

Mr. Harry Friedman, Manager, Howe Press, Perkins School for the Blind

Mr. David Kelly, Science Teacher, New York State School for the Blind

Dr. Joseph Wiedel, Professor of Geography, University of Maryland

Appendix B
Members of the Review Committee

Members of Braille Authority

Krebs, Bernard M., Chairman
Librarian, Jewish Guild for the Blind
15 W. 65th Street
New York, New York 10023

Dorf, Mrs. Maxine, Co-Chairman
c/o Div. for Blind & Phys. Handicapped
Library of Congress
1291 Taylor Street N. W.
Washington, D. C. 02542

Hooper, Marjorie S., Sec.-Treas.
American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

Mrs. F. J. Mann
Johanna Bureau for the Blind
410 S. Michigan Avenue
Chicago, Illinois 60605

*Miss Christiana Baugh
Maryland School for the Blind
3501 Taylor Avenue
Baltimore, Maryland 21236

Braille Authority Advisory Council

Dr. Berthold Lowenfeld, Chairman
Advisory Council to the Braille Authority
2928 Avalon Avenue
Berkeley, California 94705

Dr. Geraldine Scholl, Vice Chairman
Professor of Special Education
University of Michigan
Ann Arbor, Michigan 48104

*Mr. W. Robert Barnett, Exec. Dir.
American Foundation for the Blind
15 W.16th Street
New York, New York 10011

Dr. Natalie C. Barraga
Professor of Special Educ.
The University of Texas
205 Sutton Hall
Austin, Texas 78712

Mr. Robert S. Bray, Chief
Div. for Blind & Phys. Handicapped
1291 Taylor St., N. W.
Washington, D. C. 02542

Dr. Charles E. Hallenbeck
Dept. of Psychology
University of Kansas
Lawrence, Kansas 66044

*These persons could not attend the final review meeting.

Dr. Robert W. Mann
Professor of Mechanical Engineering
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dr. Douglas C. MacFarland
Chief
Services to the Blind
Vocational and Rehabilitation Services
Dept. of HEW
Washington, D. C. 06880

Miss Lorraine P. Murin
Board of Education
Jessup Road
Westport, Connecticut 06880

Dr. Abraham Nemeth
16240 Fairfield Avenue
Detroit, Michigan 48221

Dr. Carson Y. Nolan, Dir.
Dept. of Educ. Research
American Printing House for the Blind
1839 Frankfort Avenue
Louisville, Kentucky 40206

Miss Josephine L. Taylor
Coordinator
Unit of Visually Handicapped
U. S. Office of Education
Dept. of Health, Education, and Welfare
Washington, D. C. 20202

Appendix C

Reports of Committee Endeavors in Each of the Areas

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Braille Codes Pilot Project

Outcome of Endeavors of Textbook Committee

I. General Considerations

A. Format

1. Problems in the textbook area revolve primarily around format practices and rules.

2. Editing is principally a format problem, and editors and transcribers vary in their knowledge of the code and their practices of formating.

a) This variation is also true of teachers and hence educational factors or considerations become involved.

b) Should copy be rearranged or in other ways modified for reasons of logic, organization, or other meaningful considerations. Under what conditions could the copy be altered.

3. Format techniques and rules should be looked upon only as guidelines which may change with future developments.

a) Practices and rules should be kept current with changing print practices.

b) Maintaining currentness is an ongoing process and requires continuous monitoring of print and liaison with print publishers.

c) An attempt should be made to determine the factual meaningfulness of changing print practices.

d) American Printing House for the Blind has recently completed a 1970 addendum to the Code of Textbook Formats and Techniques.

B. Considerations involving the examination and evaluation of the practices and rules of the present literary and textbook code.

1. Some of the symbolism may be deleted but new meanings should not be assigned to the characters formerly used.

2. An effort should be made to eliminate inconsistencies within and across codes, e.g. those found among certain contractions whose use is dependent upon syllable division and/or pronunciation, and those for which different characters have the same meaning or vice versa.

3. Consider the resolution of difficulties caused by requiring the young child to learn different forms of the same word

   a) Determine level of introduction and frequency of occurrence of contractions, abbreviated words, etc.

   b) Consider grade level guidelines for the introduction of contractions.

   c) Would the use of ungraded text material affect introduction and guidelines.

C. Space saving is no longer the important consideration that it once was and now greater emphasis should be placed on the readability of braille.

D. In making and considering changes in the code, formats, rules, etc. it should be kept in mind that research has indicated that the unit of recognition in reading braille is the individual character and that all of the characters in a word must be sensed in a spatial-temporal sequence. In these respects braille reading is dissimilar to print reading.

E. Should the user of books be considered in transcribing and should separate rules or guidelines be developed, perhaps, for teachers and students.

   1. Should a grade level factor be considered in conjunction with the transcription of books.

   2. Should teachers edit the books before they are transcribed.

   3. When perfecting the code should attention be given to the fact that public school children often have no one available to interpret symbols, formats, rules, etc.

   4. Should there be two levels or grades of braille, one for the multi-handicapped or retarded and one for the average visually handicapped, viz. grade 1 1/2 and grade 2 for the respective groups.

F. Should special symbols and symbols of other codes be listed in the front of the book on the assumption the reader may not know these symbols.

   1. What should the transcribers do if they don't know the other codes.

   2. Would it be possible to determine the most commonly used special symbols by grade level.

3. On the assumption the reader knows the other codes could just a transcriber's note be used specifying the other codes which appear in the book. Should different types or levels of books be treated differently.

G. It is generally accepted that transcribers prefer not to have to decide the resolution of ambiguities and the determination of format. Inasmuch as the transcribers annually produce more titles than any other organization this consideration should be central to any future work on the codes.

H. Computers are playing a more important role in the production of braille and future work on the code should be focused on this development.

II. Problems involving symbology.

A. Should the same sign be used for parentheses in both the literary and math codes.

B. Should all numerals be in the lower part of the cell just as they are in the math code. This practice would necessitate the use of a special indicator to distinguish the numerals from punctuation. What could this sign be.

C. Should some of the infrequently occurring elements of the code be deleted on the basis they detract from readability and do not save much space.

D. Could some provisions be made to eliminate floating dots, the condition in which the relationship among dots in two or more cells makes the level of some of the dots difficult to determine. Would the grade level of the reader affect the readability of these configurations.

E. Contractions - their use according to the rules involves many exceptions and inconsistencies. Should their use be reviewed, and should an effort be made to eliminate the exceptions and inconsistencies.

1. Should they be used wherever they occur in the word. What should be done when their use leads to confusion about the meaning of the word.

2. Should some conditions be fixed for their use in prefixes or suffixes or syllables. Here, some of the rules are ambiguous and should be clarified.

3. Should usage be the same for all types of words and content.

F. Short-form words - their use involves many of the same considerations as those for contractions above. Why should exceptions to their use be made on the basis of commonness, pronounciation, spelling, etc.

1. Should some of the short form words be eliminated because of their infrequent use

2. Should other short form words be added to the code

G. Abbreviated word forms and measurements - should their use and rules be reviewed

1. Should some of the forms of measurements be eliminated because of limited usage, e g shilling, stone

2. Should new abbreviations be added and a standard list devised Would a special dictionary be desirable

3. Should grade level considerations be made regarding their use

H. A new sign is needed for the interobang symbol

I. Symbols and rules are needed for other and newer print strategems which are constantly being developed

III. Problems of formating

Is the proposition factual that most braille readers prefer all material flush with the left most margin because it is more accessible and diminishes search time

A. Cover identification, title pages, notes, appendices, and indices

1. Considerations involving the cover identification of books

a) Where on the cover is the best place to identify or title a braille volume

b) Where would the title be most accessible

c) In which direction should the title run - horizontally or vertically

d) What information should be included along with the title Could the Arabic numerals be substituted for the Roman for the volume number on the binding

e) Should there be different ways of titling books produced by press or publishing houses and those produced by transcribers Guidelines are needed for both braille and print title pages

2. Title pages

a) What would be the best format for title pages Where should material be placed on the page Should it be left-justified

b) Should different items of information be included for different types of material, e.g. the initial letters of words contained in a volume of a dictionary.

3. Notes of all kinds, including marginal information and glosses.

a) Could notes be classified as to their kind and function and should they be treated accordingly. Particular attention should be given to the notes of plays.

b) Should their length and number enter into how they are classified.

c) Are the rules governing the use of footnotes for foreign language (section 5, T.F.) adequate for all prose material.

d) Where should the notes be placed - next to word, at end of line, at end of sentence, at end of paragraph, at bottom of page, at end of chapter or section, in back of volume, in back of book, in separate volume.

e) Could their classification determine where they are placed.

f) How can they be referenced or indicated.

i) How can the reader determine which note goes with which indicator - by numbering, by repeating word.

ii) Under what conditions should the two procedures be used.

iii) Should there be different indicators for the different types of notes.

g) When referencing material should the Arabic numbers be substituted for Roman numerals as the code recommends.

h) What should be the order of presentation of footnotes and glosses when both are copious.

i) What are the conditions on which the orders are based.

ii) Where and how should the pages be numbered when the notes or glosses are continued over several pages.

i) Where and how should the author's initials or other references be placed and indicated when they are found below and to the right of a passage or verse and sometimes preceded by a hyphen or dash.

4. Indices

a) Are they in their most readable form.

b) Should the words be fully capitalized or italicized when they appear as such in print.

c) How should they be paginated - (see pagination III C 3) What should be done when a volume starts in the middle of a page.

d) What should be done with subheadings. How should they be indented. (See Runovers, III A, Math and Science Area)

e) Should a standard terminology be developed for the characteristics of braille and the rules of format, etc. to be used in manuals and texts dealing with braille. Should only what is used in the official code book be the standard.

5. Where should appendices and material, which is referred to and needed in the text but which is ordinarily found in the back of the print book, be placed in the braille book - within the volume where the reference is made, at the back of the braille volume, in the last braille volume, or in a supplement.

a) Should its location be contingent upon the significance of the material.

b) Could such material be classified according to different types. Should size or amount of material determine placement.

c) What should be done if the material is referred to repeatedly throughout the text.

d) Could guidelines be developed to indicate how such material should be handled.

6. Should there be more braille explanatory material in the glossary sections of books.

B. Pagination and other designata.

1. Should the title of a book appear on every page.

a) Should it be spelled out or only initialed or abbreviated.

b) How should it appear, with or without cap signs.

c) Where on the page should the title appear.

2. Where and how should the braille and ink page numbers be indicated.

a) Where on the page would the numbers be most accessible.

b) Should the ink print page number appear at the top or the bottom of the page with the braille number opposite or adjacent thereto. Should the numbers be on the right hand side of each page.

c) How should the numbers be indicated when the ink page stops somewhere within the braille page

d) How should the pages be numbered when an article, e g biography, is inserted between the pages of a text Could the phrase, "continued on page so and so", be used

3 Numbered and lettered lines including those which are to be counted or otherwise reckoned

a) Where should the numbers be placed, and how should they be indented and spaced

b) In the Bible the print numbering practice varies, should a standard practice be developed for braille

c) When lines are lettered should the letter sign be used

C Systems of pronounciation, pronounciation marks, and punctuation

1 In the 1970 addendum to the Braille Format and Techniques manual diacritical notation has been worked out for five new dictionaries - Webster, New World 1970, American Heritage, Random House, Funk & Wagnall, and Scott-Foresman Should these systems be evaluated

2 What is the purpose of having three types of stress signs Are they all needed

a) How do these signs affect the readability of words

b) Is there a grade level factor involved in their introduction and use

c) The conditions for using these signs needs to be clarified and specified more rigidly

3 What should be done with diacritic markings appearing in spelling books which are different from those provided in the code Mark according to and referencing new code revisions

a) Should special signs be provided and noted

b) Should ones from the code be used

c) Should special symbols be delineated in a standard way

d) Occasionally phonetic and diacritic signs are used together which means that the same signs having different meanings are being used in the same word

1) Would the use of a special indicator resolve this problem

ii) Could warning statements or notes be used to differentiate or specify the different systems that are used and how they are used.

4. Should the division and hyphenation of words at the end of a line be eliminated.

a) How much space is saved by the use of the hyphen.

b) Does use of the hyphen affect readability.

c) The hyphen is not used in the literary braille computer translation program.

d) Should a word be divided and hyphenated at the end of a page.

D. Plays, poetry and foreign languages.

1. Plays

a) A standard method of representing should be devised. Should the standard method be related to the type of play.

b) What would be the best way of differentiating actors parts, stage directions, and stage settings.

i) How should the different actors parts be represented. How should it be indicated that a second speaker is to complete a line.

ii) How should stage directions and settings be represented. Where and how should they be placed. How should they be designated.

iii) Where should notes be placed relative to their reference. How should this situation be treated where the notes are copious. (See IIIA 2)

2. Poetry

a) What is the best way of presenting poetry. Should a standard method be devised.

i) What should be done with poems having unusual formats, e.g. shaped like a tree, or the work of E. E. Cummings.

ii) If the print format is not followed how could the appearance or structure of the poem be indicated to the reader. Is it necessary to show this.

iii) Should a transcribers note be used describing the structure of the poem

3 Foreign languages

a) All languages for which braille notation is available need study of their symbology and its use. Review should be made of M. Loomis Standard English Braille in 20 Lessons, 1947, for her treatment of accent and diaeresis signs in foreign languages

b) Transcribers should be consulted about foreign languages because there are differences among them in the way they treat ambiguous or problem situations

c) In print language texts much of the material is presented spatially - how should it be done in braille. Some guidelines for certain braille representations can be found in the grammar section of the Textbook Code and need to be cross-referenced

d) Should notation and rules be developed for languages for which provisions are not presently available, e g. Portugese

e) In developing material for foreign languages it should be kept in mind that the transcriber doesn't necessarily know the language with which he is working

f) It is the attitude of many that English braille and foreign language braille should be kept separate, i e , special provisions for each

i) In changing or shifting from English to a foreign language, e g in a grammar book, there is nothing to indicate the change, which situation is confusing to the reader

ii) Should some symbol be used for this purpose. Could the italics sign be used to show the change of language. If so, what would be done with material that is already in italics

iii) More provisions on the use of italics in these situations are needed in the TF manual

g) For the transcription of foreign words braille, grade I is used while the other characters represent accent and sounds

i) The braille phonetic code conflicts with braille accented letter signs of foreign languages - could this situation be remedied

ii) How should inflections within and between words be represented in foreign language transcription For rules on inflection between words the foreign language section of the TF manual needs to be cross referenced with the speech instruction section

iii) Should the slash, which ordinarily has no space on either side, be accompanied by spaces if it appears so in print In Spanish and Italian the sign for the slash also represents the vowel sound i acute Could the dash be used instead of the slash symbol

iv) In foreign languages italicized vowels mean that the vowel is stressed, however the s also is frequently italicized which indicates it carries the "z" sound How should these items be represented in braille where there is a special sign for stress and a sign for italics

v) In Italian acute symbols for the vowels are needed

vi) When the text or main part is in one language and a footnote or reference is in another should the accent signs differ for the same word in the different languages

h) The diaresis ¨ in French Textbook Format allegedly is confused frequently with the macron What could be done to eliminate this confusion

i) When most of the words of a sentence are in English what should be done when to, into, or by comes before a foreign word Should these prepositions be contracted or written out and should they be placed adjacent to the foreign word

j) In German only the first letter of nouns is capitalized and the double cap sign is not used - capitalization serves as an earmark When following the rules for titles and using double caps, what should be done to distinguish words capitalized within the title

k) In the TF manual could the words "in the entry" be inserted after "used" in the first line and the colon and definition be added to the examples to clarify that item

l) On the title page of foreign language books the title uses the special symbols of the language but the rest of the information - author, publisher, etc - is in English Is this a desirable practice - how should the title page items appear

m) In Spanish the opening and closing conversation signs are confusing. In print it is a dash. The braille sign misleads the student and violates the braille rules when used adjacent to a period. What should this sign be? Could it be a dash the same as in print. A rule is needed specifying that the Spanish custom of not using a closing conversation sign should be observed by transcribers.

n) In foreign language should the division of words and hyphenation be treated differently from the practice of English braille. To what extent should the foreign language format be followed compared with that of English braille.

E. Print devices for emphasis

1. Headings, capitalization, lines above and below, color, etc. are means of emphasizing or distinguishing material in texts. What should be done with them in braille.

a) Should the transcriber have to determine whether these devices are only commercial artifices or meaningful to the text

b) In resolving these problems a central consideration should be the differences between working on plastic, paper, and metal.

c) Transcribers usually delete as much of these devices as possible - Should there be conventions for this.

2. What should be done with italics and the italic sign. The Braille Authority has been asked to eliminate this sign.

a) Its use requires a subjective judgment of what should be emphasized or distinguished.

b) There is also the matter of when it should be introduced in Braille.

c) What effect does its use have on the readability of braille.

d) Could more meaningful objective conditions for its use be established

3. Double caps - In ink print there are three types of caps - should these be represented in braille.

a) When should they be used or not used. Should some other procedure be used for directing attention to the material.

b) When a considerable amount of fully capitalized material appears within the text should some symbol other than the double caps before each word be used. Could the italics principle be used

c) How much space should be saved for varying amounts of material using double caps as opposed to a symbol preceding the capitalized material.

4 Underscoring What is the best method - dots or smooth line.

a) Should spacing between underline and material be considered. What is the optimum spacing between the line and the material above and below.

b) Is there a grade level factor involved which is related to spacing

c) Should italics be used instead of underline. Under what conditions should the italics sign be used. When should the switch be made

5 Paragraph headings - material on headings needs review and clarification

a) Have too many distinctions and provisions been made for the different forms of headings, subheadings, etc. Could this matter be simplified.

b) Should a line be skipped before a heading to emphasize change in topic

c) Could the differentiae for the various types of headings be specified. Should the treatment of these types be standardized or only kept consistent within a text.

6 Colored type - its use is on the increase considerably.

a) What should be done with colored print - should it be coded, or boxed or underlined, etc

b) Should a judgment be made about whether the material is meaningful or referenced in the text or whether it is merely for eye appeal, and then treated accordingly

c) What should be done with colored sections of books.

d) What should be done when different shadings of colors are used for different purposes

e) Should different constructions be developed for different situations - could these situations be listed.

7. Where and how should arrows be placed that point to words or different parts of words.

   a) Should different practices be set up for different situations.

   b) Can these different situations be determined.

IV. Problems of Displays - Displays are considered here as any figures, drawings, etc. which are part of a textbook, but which have an integrity of their own, and can be treated separately from the text and its format. A note of caution, the meaningfulness of this definition is limited because ultimately what is importnat to the reader reduces to that of the readability of the whole braille page. For more considerations on this topic see Maps, Charts, and Diagrams Area.

A. Outlines, tabular, and test materials.

1. Outlines - related to numbered sections, numbered sentences, exercises, drills, tests, headings, table of contents, and poetry.

   a) Is the present form of successively indenting each subunit two spaces and bringing runovers to the margin the most readable.

      i) What should be done with large outlines.

      ii) Should a line be skipped between groups and before a topical heading.

   b) New publishing techniques are replacing the traditional standard outline format.

2. Tabular material

   a) What is the best arrangement or technique for presenting this type of information.

      i) Should it be presented horizontally or vertically. What is the best arrangement in each case.

      ii) Should different types of material be presented in different ways.

      iii) Could tabular material be classified.

   b) What should be done with large tables running across a number of pages.

      i) How should the tables be segmented.

      ii) Could techniques for using facing pages be developed.

c) How should columnar headings be indicated.

i) Could they be keyed.

ii) Does their treatment depend on their length.

d) What should be done with footnotes in the table.

e) What concepts should be taught to children to enable them to read tables.

3. Test materials - consider with outline and tabular materials. For this item the only concern is with readability.

a) Should different types of test material be treated differently.

i) Requires classifying different types of tests.

ii) Should tests also be classified according to types of response required.

A) What would be best way of marking answers - depends on responses required.

B) What should be done when answers are to be checked, circled or underlined - need keying technique, what is the best type of key.

b) How should columned material be numbered or designated. Review Rule 12 and Appendix E in the Textbook Format manual.

i) Is horizontal or vertical numbering the most readable.

ii) For public school blind children are the designations similar to those used by the sighted child and teacher.

c) How should materials be divided within a page and across pages.

i) Should questions and answers be separated across pages.

ii) For long columns of materials could facing pages be used.

B Pictures and picture captions

1. In general, pictures cannot be reproduced in an embossed form and be tactually meaningful. Also, transcribers express the feeling they are not qualified to determine the educational value of pictures or describe the pictures adequately or in the appropriate vocabulary.

2. Should efforts be made to develop simple embossed pictures or symbols to represent frequently occurring objects or shapes.

3. What should be done if the pictures cannot be represented. What if the text is dependent on the pictures or that the pictures have some function, e.g. counting.

   a) Should the pictures be described. What is their educational value - can this be determined.

   b) What if questions are to be answered from the pictures.

   c) Should the vocabulary level of the description be considered.

   d) If special symbols are used in place of pictures where and how should they be placed on the page.

   e) Does their placement depend upon their function. How can this be determined. Could common functions be classified and guidelines developed for their use.

4. Should the representation of pictures be considered from the standpoint of lower and upper grade levels.

5. Should social-emotional effects of having materials similar to sighted peers be investigated.

6. What should be done with the captions of pictures.

   a) Where should they be placed.

   b) If the picture cannot be represented, what should be done with the caption.

      i) Should it be included. Should its inclusion depend on the information it contains.

      ii) Where should it be placed on the page.

      iii) What would be the optimum size of books when pictures are deleted and there are only one or two words per page.

      iv) How and where should these kinds of pages be numbered.

C. Business forms

1. Very little work has been done in this area. The area needs considerable research and the development of techniques and guidelines for handling the many diverse forms.

a) Efforts made in this area should consider the changing nature of the forms, especially those changes coincident with the use of computers in processing forms.

b) Could the different types of forms be classified and techniques and rules developed for the most common types.

2. The principal problem with forms is that most are too big to fit on a single braille page.

a) How should the detailed and small print information be handled.

b) Could keys or symbols be used to indicate the location of information with the information appearing elsewhere.

c) Could a procedure be used wherein the overall form is presented first with the sections numbered and later elaborated. Should the overall form be presented before or after the elaborated sections.

d) Could facing pages be used in presenting the forms.

3. In addition to business forms work needs to be done on time tables, schedules, etc.

4. Should a manual of guidelines and instruction be developed for this area, or would it be better to enlarge this section in the code book.

D. Diagrams

1. What is the best arrangement for diagrams and where should they be placed on the page.

a) How should larger diagrams be handled - could or should facing pages be used.

b) Could keying techniques be used in diagrams thus allowing a smaller representation.

2. Should different types of lines be developed for different figures and diagrams or parts of diagrams.

3. In the format book examples are needed for simpler types of sentence diagramming.

E. Time Lines - rules are needed for these figures. They are presently treated in an outline format.

1. Should they be handled differently depending on whether they appear horizontally or vertically, or should a standard method be devised.

2. What can be devised to indicate the points to which the lines refer.

3. How should instances of overlap be treated.

F. Family trees - these displays need directions. They are presently treated as outlines.

1. Can some other method be devised for their representation - can they be displayed diagonally perhaps across facing pages.

2. How should married relations be treated.

VI. Factors needing development

A. Biology, Botany, Zoology.

1. Needed are notation, formats, and rules.

B. Medicine.

1. Needs complete development.

C. Geography and geology.

1. The big problem in these areas concerns maps, charts, etc.

D. Linguistics.

1. A new area gaining rapidly in acceptance and for which symbology and rules are needed.

E. Money and Commerce.

1. Items of difficulty in this area have to do with diagrams, tabular material, stock reports, etc.

F. Biblical reference symbols

1. Most of the problems have to do with the vagaries of numbering found in the different editions of the Bible and how they should be treated in braille.

2. Should a standard numbering system be developed for all biblical references.

3. Should the biblical reference symbols currently used be evaluated.

G. Coding

1. Refers mainly to Morse code, semaphore, and cryptography and how these systems can be represented tactually.

2. Also includes cross word puzzles, acrostics, chess moves, bridge displays, etc. which would be related to tabular and graphic display materials.

H. Cooking - the representation of recipes and instructions.

1. What kind of format should be developed for recipes. Should it be standardized.

2. Should a standard list and symbology be developed for the measures and tools used.

I. Handicrafts - sewing, knitting, crocheting, tatting, weaving, basketry, etc. all need symbology, rules, and formats for directions and displays developed for them.

Braille Codes Pilot Project

Outcome of Endeavors of Music Committee

I. General Considerations

A. Computerization of music

1. Computers will eventually play a significant role in the production of braille music, especially for the simpler and elementary level music.

2. The braille representation of the more complex music requires stylistic and interpretive decisions which will be difficult for the computer to handle.

3 The American Printing House for the Blind has embarked on a project to develop a computer assisted music translation program. The initial phase of the project runs from May 1971 to June 1972.

4. The computerization of braille music will lead to a more standardized reporduction than was heretofore possible.

a) Decisions concerning problems in the present code should be made in light of eventual computerization and standardization of practice.

b) On the other hand, any changes in the code should be made from the standpoint of the reader and a workable code and not ease of computerization.

B. Print music

1. In print music there are different ways of depicting the score; also there are anomalies peculiar to a composer or autographer, and sometimes the text contains errors. What should be done with these things - should the anomalies and errors be changed; should standard guidelines be developed and specified for these variables.

2. The exact duplication of inkprint copy results in the representation of some unnecessary symbology and material in braille, e.g. clef signs and parentheses. Should there be less emphasis on showing exactly what is in print. Could conventions be established for what should be included in braille. Should a grade level or a beginning music level factor enter into what is represented in braille.

C. There are a number of different methods of presenting braille music, e.g. bar over bar, line over line, etc. whose use is determined by considerations based on the music.

1. Can the conditions under which these methods are used be specified and listed.

2. Should one method be preferred to another. Could the best method be determined.

   a) Should bar over bar be used in preference to line over line for simple and elementary music.

   b) Should line over line be used more often. Under what conditions.

D. The reading of intervals for solo instruments in the trebel clef and orchestral scores varies - solo read downwards and orchestral read upwards

   1. Which is the best method of reading.

   2. With the exception of keyboard music why couldn't all intervals be read upward.

E. The code book needs more directions and greater specificity of rules and guidelines. Also needed are more complex types of examples where the notation runs for two or three parallels for each hand. This material could be placed in a supplement or addenda and cross referenced with the code book.

II. Problems involving symbology

A. <u>In accord</u>:

   1. Under what conditions should full measure in accord and part measure in accord be used.

      a) Could rules be developed to determine when the two "in accords" should be used, e g. defining short and long measure, the former being the case where both parts will fit within one braille line.

      b) Can the conditions be specified for the arrangement of parts, relative to the in accord sign, which tend to preserve the melodic character or continuity of the measure.

B. Repeats

   1. In general limitations regarding when to use repeats need to be more precisely delineated in the code manual.

   2. When measures are repeated from one page to another should a repeat sign be used at the beginning of the new page or should the measures be written out.

3. Could conditions be determined for specifying when repeats should be used with certain types of material, e.g. vocal, and with variations in the music, e.g. with strong and weak beats.

4. In partial abbreviations is the repeat with the number sign confusing - this usage requires the counting of measures.

5. In the use of octave repeats does the space between the characters cause a loss of orientation and determination of level of character.

C. Grouping

1. Could the conditions for the irregular grouping of 16ths be clarified and expanded. Is it desirable to use the music comma and grouping symbol together.

2. Where notes are grouped and a visiting hand must play all or part of the group, should the hand sign be placed before or after the grouping sign. This situation needs specification in the code manual.

D. Accidentals

1. In carry-overs to a new parallel should the accidental sign be repeated. Conditions covering ties and accidentals need clarification in the code manual.

2. When a tie occurs at the beginning of a new measure should the accidental sign be repeated before the second of two tied notes.

E. Accents.

What would be the best order or arrangement of the accent signs. Should they be alphabetical with staccato signs coming first or would some other type of order be more desirable.

F. Clef signs

1. For changes within a parallel how significant are they. In this situation could the clef sign be eliminated for the braille reader. If the sign were eliminated should provisions be made for the teacher.

2. Should a transcriber's note, possibly in the front of the music, indicate their absence.

3. For a tenor part written in trebel should the notes be transposed an octave lower by the transcriber.

G. Braille Rests

1. Their indiscriminate use is often confusing and breaks melodic flow. Can conditions governing their insertion be amplified.

2. Should symbols showing loudness or softness precede the rest sign or come before the note Could more adequate provisions be made for this condition in the code manual.

H. Ties and Slurs

1. When beats or measures are tied together in a new parallel or line should the tie sign be used again before the new measure and before the in accord sign. The rule implied in example 97 of the code manual needs changing or clarification. Also, two examples of this situation in the manual are contradictory

2 Where should the tie or slur sign be placed when the repeat sign precedes a numeral. A rule covering this situation is needed in the code manual.

3 To avoid confusion and promote easy recognition of the course of the music how should a slur used in one voice but not another be indicated.

4 Under what conditions should the grace note slur be used. Should it only be used under the bracket slur. Clarification regarding the use of this slur is needed in the manual.

I. How should stem signs be applied to show that the word distribution is different in two languages.

J. The present practice of marking octaves apparently causes difficulty for the beginning student. Could all intervals beyond the second and third be marked. Should marking all intervals be confined to introductory materials.

K. Symbology needed within framework of present code.

1. A sign is needed indicating the use of two fingers striking a note Could it be a dot before the second finger mark.

2. A symbol is needed showing a tie from part of one measure to part of another measure, a part-to-part tie

3. A sign is needed for a slur which is not tied to any note at all, a null-tie

4. In some configurations it is difficult, especially for the young child, to determine alignment or level of dots. Could a reference sign be developed to aid judgment.

5. Symbols are needed for new print signs of operations and functions which are continually being developed, e.g. wah-wah. Such signs can be found in current music dictionaries.

III. Problems of Formating

A. Nuances and word expressions

1. Where unequal expressions or directions appear at the beginning of a new measure how should the first notes of each hand be aligned.

a) Disregarding vertical alignment on the pedal sign should alignment be different for symbols of execution and pedaling.

b) The rules governing the practices of alignment in the code manual are not specific enough and the examples shown are inconsistent.

2. The directions regarding the placement of the ends of diminuendos and crescendos need to be clarified and expanded.

B. Choral and vocal music

1. Should there be one way of juxtaposing the words and music.

a) Since there are usually more words than notes and to prevent one hand from going under the other should the words always be above the music.

b) Should the poetic line and the music correspond or be vertically aligned.

c) Should exceptions be made for different types of material.

2. Could a sign or some other indicator be developed to show when a syllable is stretched over a number of notes.

3. Where and how should a word or syllable be divided between lines.

a) How should the hyphen be used to divide the word or syllable.

b) The rules covering this situation need to be clarified and extended.

4. At the elementary level when the words go with the music is it better not to have runovers of the music.

5. Could the lines of words and music each be placed on separate facing pages.

C. Measure division and runovers.

1. For in accord measures where one hand is longer than the other and longer than a braille line should you use runover lines or bring the remaining part to the next parallel.

   a) What should be done when both hands are longer than the line.

   b) Where should the division be made.

   c) A rule is needed to cover this situation. - present rule inadequate.

2. For complex music rules governing runovers are inadequate. Rules are needed covering the exceptions in very florid types of expressions where proper division cannot be made.

3. In general more rules and examples are needed covering runovers in a greater range of situations.

D. Pagination

1. What is the best manner of numbering pages.

2. Should page numbering be the same in music, theory and textbooks, and manuals.

E. Measure numbering

1. In what cells should the numbers begin

   a) How should spacing be done for digits, tens, and numbers. Spacing should allow for dot 3 indicating runovers.

   b) A rule is needed covering this situation.

2. For solo stringed instruments how often and in what form should measure numbering appear. This should be indicated in this manaul.

3. What should be done about measure numbering in unbarred music Could the parallels be numbered and accompanied by a transcriber's note.

4. In choral music provisions are needed for the numbering of new braces or the beginning of new braces.

F. Key and time signatures

1. Should the key and time signatures of the score be placed at the top of every page.

2 Should the change of signatures within a page be included.

3. Could something be devised to indicate which keys are to be played. This is particularly important for the young child.

G. Footnotes

1 How should footnotes be indicated. Clarification is needed in the code manual.

2. Where should they appear relative to their indication.

a) Should the note be placed within the piece following the parallel in which the indicator occurs, at a suitable break in the music, or at the bottom of the page.

b) Should the note be indented or placed under the hand signs.

c) Should the notes be separated from the other material by lines of dots 3 and 6.

H. How should figurations be handled which are to be performed with both hands but written in one voice.

I. When a light double bar is presented along with a fermata in what order should the braille signs appear. A rule is needed for this situation in the code manual.

J. At the beginning level the code advises an extra space between lines. How does this affect the child's ability to align the notation vertically. If the practice is not followed the rule should be deleted from the code manual.

K. Is the use of tracker dots adequate. Should they be used in situations where there is less than seven spaces between symbols. Should a grade level factor be considered with regard to their use.

L. Formats for theory books

1. Formats require considerable study and guidelines for transcribing.

2. Figured bass and chord analysis.

a) Rules and symbols are needed for this material.

b) What is the best way of presenting.

c) Is interval interpretation easier when represented by numbers.

d) For reading intervals the current code symbols are in contradiction with print and with logical ordering in harmonic constructions Could more desirable alternatives be developed.

3. For exercises showing intervals how should chords be represented - should they be spelled out using the in accord sign.

IV. Factors needing development

A. The development of notation and rules for different types of music and materials.

1. Tonic Sol-fa.

a) The notation for this method is presently going out of use. The majority of educators now favor the fixed dō, however its use still preponderates in the public school system.

b) Rodenberg has developed braille notation for this type of music and Jenkins has adapted it to correspond with the music code Jenkins'adaptation could be part of an addendum to the code manual.

2. Liturgical music - Gregorian and Anglican chants.

a) For Anglican chant a code developed by Rodenberg has been revised by Jenkins. This revision could be used in any future developments.

b) Should both methods of presenting - numismatic and round - be considered for development.

c) How should material be written if accompanied by organ.

3. For ensemble piano music alternative ways of presenting the material needs to be examined.

4. Orchestration

a) In full score the horizontal placement of notes is important - could the word sign before the instrument be eliminated to gain an extra cell which is sometimes needed.

b) Examples of orchestral scores are needed for the code manual Thesecould be included in an addendum to the code

c) Full conductor's scores - should more of the type material be transcribed, how much of a demand is there for it. Need survey

5. Band material - not adequate supply - the residential schools would like considerably more of this type of material.

B. The development of notation and rules for different instruments.

1. Accordian - Should the 7th octave sign be used for those accordians which have the augmented interval.

2. Drum score

a) Need notation for notes and procedure. Would open score be better than in accord - may be more suitable for computer production.

b) Should a choice be made between the two methods of presenting - should you use the left, right hand signs or the left, right toe signs as borrowed from the organ.

c) Could other percussion instruments be given a note on the staff in positions not occupied by the snare and bass drums. Guidelines are needed for selecting these instruments.

3. Guitar

a) Is now very popular. Needs considerable study and development of notation.

b) Should octave transposition be made for guitar by the transcriber.

c) Notation is needed for showing picking patterns and all types of fingering - right and left hands, rest stroke, free stroke, flamenco roll, etc.

d) Because of greater frequency of low notes should note reading be done upwards.

e) Should grand barre' signs alone or with the continuation sign be used for capo, a transposing device.

f) In general could the up-pedal sign be used for damping of all instruments.

g) Could something be devised for representing tabulatures.

4. Harp

a) Needs considerable notation and rules for functions and procedures of music and teaching materials.

b) Edward Jenkins is presently working on the codification of braille for this instrument.

5. Mandolin - Treat with guitar. This instrument is fingered like a violin and strummed with a double stroke. A major problem involves the use of signs for position vs. fret.

6. Organ

   a) Should use of open score be contingent upon whether music is homophonic or polyphonic.

   b) Parentheses differentiating the Hammond and other organs are used indiscriminately. Should different signs be used for the two classes of organs - perhaps the parentheses for the Hammond and the word sign for the others.

   c) When registrations are given for both classes of organs at a certain point in the music how can they be differentiated.

   d) Provisions for chord organs need to be established.

7. Solo wind instruments

   a) How should finger charts be displayed.

   b) Could charts be compiled into separate pamphlets for the various instruments.

8. Recorder

   a) Much music has been done in England for this instrument.

   b) Fingering presents a problem - need charts to indicate what fingers produce certain notes.

9. Modern Electronic music - elements and notation too recent and unstabilized. Should not consider at this time.

10. The code manual.

   a) The code book needs to be reviewed for completeness, inconsistencies and errors.

   b) The general index of the manual is inadequate and needs elaboration and cross referencing.

   c) The designation braille music comma should be changed to the ligature sign.

V. Resources for future development

A. The items listed in this section are far from a complete specification of the considerable amount of work and talent which exists

in the field of braille music. They are merely a few resources which were mentioned during the committee meetings and which would be available for further work on the code. Foremost among them are the members of the committee and especially Mr. Edward Jenkins who is currently devoting considerable time to abrogating some of the insufficiencies in the area.

B. Messrs. John Siems and William Watson at APH are currently developing a computer assisted braille music translation program.

C. Mrs. Erlandsen is presently engaged in reducing and revising orchestral scoring in braille.

D. Mrs. Stella Jenkins has developed a system for brailling the Tonic Sol-Fa notation

E. A comprehensive source for information about orchestral music is the Thesauras of Orchestral Effects by Gardner Read.

Braille Codes Pilot Project

Outcome of Endeavors of Math and Science Committee

I. General Considerations

A. In planning or considering codes for different fields some variables are distinctive to each field and others are common across all fields - vertical and horizontal factors. An attempt should be made to make codes compatible horizontally or where they share commonalities and avoid having different symbols for the same or similar situations. This requires the determination of common elements. Would a computer be useful in listing or keeping track of instances where symbols or rules are used.

B. Possibly useful would be a distinction between format problems and problems of spatial arrangement. The latter refers to relationships internal to an item such as a diagram or graph, and the former refers to relationships of the text to the page and to other items on the page. On the other hand, this distinction cannot be applied too rigorously because the readability of the material must be determined within the context of the page, and thus it is the total arrangement of the material on the page which is important.

C. Concerning a philosophy towards the translation of print material into braille the following points should be considered.

1. Insofar as possible should there be an exact duplication of print to braille or should the print be edited on the basis of what is tactually meaningful. In other words, should greater emphasis be placed on imparting the concept or comprehension of the material rather than making the braille isomorphic with print.

a) How important is it for the student to know what the print format is like.

b) What factors relevant to the issue should be considered from the standpoint of visually handicapped students in public schools.

c) Editing entails a decision of what should be reproduced. Who should make this decision and on what basis. What kind of editing is useful or desirable.

i) How would editing affect transcribers. They do not want or feel qualified to decide what should be deleted or changed.

ii) Should teachers edit the books before they are transcribed. Relatedly, could procedures be worked out for transcribing both parts or sections and the whole of a book.

iii) Would joint teacher-transcriber editing be feasible and resolve some of the problems inherent in the issue.

iv) Should grade level considerations enter into this matter. Should an attempt be made to determine what the regular class teacher of the lower grades, K-4, requires and expects of the blind child with regard to the use of the material in print books. How much is meaningful and used by the resource or itinerant teacher. Could information of this type provide the basis for editing lower level math books.

2. At the elementary level teachers feel that the math code is too complex and that more time is spent working with the code than with the math concepts.

   a) Some code elements may interfere with the concepts being taught, e.g. work with square figures often does not occur until the third grade but the symbol for the square is introduced in the first grade. How does this situation influence the child's concept of a square.

   b) Could the code be simplified for elementary level students. Would a graded teaching manual alleviate some of the difficulties with the code encountered by the young child. Should math series be surveyed for introduction of symbols and concepts and the results used as a basis for the introduction of symbology. Would changes in subject structure or curriculum affect the manuals.

D. Should lesson books for the codes be developed for teachers.

E. Should manuals of format and techniques be developed for each of the codes. Should the manuals be cross referenced and specify priorities of rules and codes which take precedence.

F. A recent revision of the math code has been made but it has left unattended a number of items which should be included in the code. A review of the code is needed to determine what is missing and what should be included.

G. According to volunteer agencies, Nemeth Code transcribers are diminishing.

   1. Eventual certification of math transcribers presumably by the Library of Congress is anticipated.

   2. Absence of official adoption of the Code has been considered partly responsible for the decrease.

H. Because of the few number of volunteer transcribers of the math code and the increased use of computers in the production of literary braille efforts should be made to computerize the math and other special codes and to consider this contingency as central to the development of other codes.

I. There is general agreement that the American Printing House for the Blind should assume a leadership role in the work on the development and standardization of the braille codes and on assuring the future production of braille.

II. Problems involving symbology.

A. In the math and literary codes the parentheses signs are different.

1. Should they be the same. Under what condition should each be used.

2. In the most current revision of the math code only one sign for the parenthesis is used. Does this revision cause other difficulties and require other changes in the code. What are they.

B. In the math code there are two commas. Would it be possible and desirable to eliminate one of them. Could the characters for the dot two comma and the apostrophe be exchanged.

C. The use of the punctuation indicator is variable. Could this variability be eliminated and uniform conditions established for its use.

D. Under what conditions should the English letter indicator be used. Should the letter indicator be used at all - can the material be read either way. In the current revision of the math code its omission in certain situations may cause difficulty. What are these situations and can they be corrected.

E. Are the rules regulating the use of the numeric indicator the most efficient. Could the use of this symbol be made more efficient and explicit.

F. Roman numerals are presently depicted using the sign for double caps. Does this array interfere with the alignment of terms when doing computations. For computation purposes do the terms need to be aligned.

G. In print, fractions and cancellation both are represented two different ways. In braille fractions are represented both ways but cancellation in only one way.

1. Are both ways necessary and mathematically significant.

2. Are there conditions which can be determined that will specify when each form should be used.

H. Do the directional symbols of the Nemeth Code always mean the same thing. When arrows or directional operations are represented differently from those depicted in the code can the code symbols be used

1. Is the meaning of the different representations the same.

2. In print the designation of a diagrammed ray makes no distinction as to direction of the ray. Should the direction be shown in braille.

I. Math symbology needing development

1. Symbology for ancient numeration systems - Egyptian, Babylonian, Chinese, Mayan, Greek.

a) There is not complete agreement on how the ink symbols are depicted. Should this material be edited. How frequently and under what circumstances does it occur.

b) Should braille characters be used to represent these systems. Could some other symbols, possibly more similar to the original, be used.

2. Notation is needed for number systems to different bases. Recently notation was developed for bases 12 and 16. Does this notation need to be evaluated.

3. Other special symbols which appear from time to time. Notation is needed for new symbols and symbology appearing at lower grade levels as a result of changes in curriculum.

III. Problems of format

A. Runovers (Analogous to Division and Hyphenation of words in Textbook Area).

1. Should certain types of material be treated differently regarding division and continuation from one line to the next, e.g. linked and non-linked modes.

2. Where should different types of material be broken.

a) Should links in math expressions enter into and perhaps, determine where the expression should be broken.

b) How should runovers within links be treated. Should complete links be written on separate lines.

3. What should be done for different types of material which are divided between pages.

4. How should the break be indicated. Does it need to be indicated. Could a priority break list be developed.

a) When divided at a sign of operation should the sign of operation or comparison appear at the end of the line, at the beginning of the next line, or at both places.

b) Should a hyphen or other type of continuation sign be used with the divided material.

c) Where should this sign be placed in relation to the break.

d) Should it appear both after the break and before the resumption of the material.

e) Should division and indicators thereof be handled differently for children in the lower grades.

B. Margins

1. Should different types of material be treated differently. Could different types of material be classified and specifications developed for the different classes

2. Where on the following line should a runover begin. Should it be indented

3. Should different types of runovers be treated differently. What should be done with successive runovers.

4. For numbered and lettered material where should the designators be placed. Alignment should be considered for the number of cells required by the designators. (See Textbook Area, Pagination and Other Designata)

C. Variant type forms or print devices for emphasis (See Textbook Area, Print devices for emphasis)

1. Should textbooks be surveyed to determine whether the variant forms have mathematical significance or are just for eye appeal. Could the variant forms then be classified.

2. No provisions are made for distinguishing colors, different sized type, or different types of script.

a) Should symbols be developed for these things. Should symbols be standard across areas.

b) Where should these symbols be placed in reference to the material being modified

c) Should a standardized list of symbols for colors be developed.

d) When a special braille symbol is used for a special print symbol, should the print symbol be depicted somewhere so the braille reader will know how it appears.

D. Transcriber's notes.

1. When transcribers notes and keys are used with displays what should be done about the following: placement, division, indentation, spacing, designation, vocabulary level and differentiation of author's and transcriber's notes.

2. Should there be special symbols indicating a transcribers note.

3. Where should the indicators and notes be placed relative to the material referenced.

4. For the mathematics code a transcriber's grouping symbol, dots 6 & 3, has been developed which is placed before and after the note Is this the best form of indicator that can be devised

5. In composing notes the grade or developmental level of the vocabulary should be appropriate. Could standardized messages for frequently occurring conditions be developed.

6 How should transcribers notes be spaced relative to margins and material above and below Should different types of material be spaced differently, e.g. literary vs. exercise material.

E. Formal proofs and definitions

1. What should be done with the development of mathematical principles; in other words, how should the theorem, hypothesis, conclusion and proof be represented.

2. How should the statement and reason of the proof be represented.

   a) Should the statement be in bold face or italicized type. Should some other special indicator be used to delineate and distinguish the two

   b) Should the statement and reason be alternately presented. How should they be designated, divided when runover, and indented

   c) Should the statement and reason be set up side by side. Should different types of material be set up differently.

3. What should be done when a bold face or other type is embedded in another special type such as italic. Provisions are needed for this situation

4. How should line segment designations be treated Should a row of dots 3 and 6 placed above the material be used to designate the segment.

5. How should other material related to proofs and definitions-figures, diagrams, etc - be set up and arranged on the page. (See Section IV below and separate area of Maps, Charts, etc.)

IV. Problems of Displays. Those most frequently associated with mathematics.

A. General considerations.

1. In the introduction a distinction was made between problems of format and problems of spatial arrangement. In this section problems of spatial arrangement are treated under the slightly broader heading of displays. The heading, displays, is used in order to be more inclusive; otherwise, the two terms are synonymous. In addition, the objection made to the earlier distinction is also applicable to the present classification, viz. it is the total arrangement of material on a page which is important to readability. The differentiae justifying both the present and earlier distinction are that the display items are ordinarily spread out and have a certain integrity or completeness of their own apart from the text.

   For information on more general types of displays see Textbook Area, Section IV and Maps, Charts, and Diagrams Area.

2. This whole area needs considerable study which should result in the development of principles governing the representation of displays. A useful starting point may be a survey of transcribers to determine what principles they use, principles which may be intuitive or have been passed along as folklore. These guides used by transcribers should be defined and investigated.

3. In the reading or interpretation of displays there is a learning factor involved which should be considered when they are studied. There may also be a developmental or grade level factor involved which should be investigated.

4. Should the different types of production - one-sided vs. two-sided be considered in studying displays and developing symbology and tools. Should the developments be the same for all types of production.

5. For large displays could facing pages be used.

   a) Could new, more efficient techniques be developed for setting-up and using facing pages.

   b) Could conditions be determined under which facing pages should or could be used fruitfully.

6. Could different representation techniques such as the "skeleton" procedure and the "building" technique be further developed for handling displays.

7. Could a keying technique be developed and instances where it would be useful delineated.

9. Could tools be developed for the construction of displays and symbols within the displays Should the symbology and tools be standardized

9. Should an instructional manual on displays be developed for transcribers Should the procedures be standardized or only serve as guides

B. Problems of math expressions in general.

1. There are different kinds of displays for the different areas of math - plane and solid geometry, trigonometry, calculus, etc Could these displays be reliably classified and treated on the basis of their classification

2. Could math material be classified to determine what should be spatially or linearly represented.

3. In math expressions which are spatially arranged. What should be done with such items as lines above and below material, lead lines, arrows pointing to results, arrows showing the direction of operations, boxes, steps, vertical bars, circled numbers, and numbers above and below and to either side of others

a) How much of this material is meaningful to the braille reader

b) What is the best way of tactually depicting this material.

c) Where on the page should this material be located.

d) Should a line be skipped above and below a spatial arrangement.

e) How should the material be spaced relative to process words in equations, viz therefore, thus, since, and, but, etc

f) What should be done with material for the lower grades where lines are normally skipped.

g) In general, should grade level considerations be made with regard to spatial arrangements.

h) Could some of the material be placed on facing pages.

4. Is knowledge of the visual, spatial arrangement necessary for the student to achieve understanding and comprehension of the concepts involved.

C. Formulas and equations

1. Should formulas be treated differently with respect to their placement on the page and their spatial or linear character.

   a) Should formulas be represented in different ways according to the operations to be performed on them, e.g. fractions and cancellation both are represented spatially and linearly.

   b) Should the representation of formulas be considered on the basis of possible ambiguity or conflict with vocabulary of operations, e.g. for division of fractions, invert or multiply.

   c) Should the extent of formulas or equations affect how they are handled.

   d) How should embedded and isolated formulas and equations be handled.

2. How should successive terms of equations be vertically aligned. Should the inkprint be followed, e.g. alignment on the equals sign, or should some other form be developed.

   a) Should certain kinds of formulas be treated differently.

   b) Does alignment on the equals sign have any mathematical significance.

      i) Is the equals sign and alignment important to the solution of identities.

      ii) What should be done where expansion represents steps of an operation, e.g. the evaluation of exponents.

      iii) What should be done when the left hand terms of an equation remain the same.

3. How should runovers in formulas and equations be treated. (See Runovers, II A)

   a) Where and how should a division in equations be made.

   b) Should the number and size of links influence how they are divided.

   c) Where and how should the break be indicated.

   d) Where should the equals sign or any sign of comparison appear with respect to links ending or beginning a line.

4. What should be done with explanatory, or boxed, or reduced-type, multi-lined subordinate or accompanying formulas or material.

   a) Where should this material be placed.

   b) How should it be referenced.

   c) Is the transcriber's enlarged grouping symbol adequate for delineating this material

   d) Should different types of material be treated differently.

   e) Should boxed material be enclosed. Could the enclosed material be keyed for the information it contains.

   f) How should formulas placed alongside a commentary or explanation be treated.

5. Where should reference numbers for formulas be located with respect to the formula Should they be consistently placed on the left, right, or both sides of the formula

6. Should a line always be skipped above and below formulas and equations or should the print practice be followed.

D. Displays for algorithms

1. The representations of all kinds of algorithms, such as the following, need to be studied for their readibility and an optimum format developed - addition, subtraction, multiplication, division, square roots, converting numbers in one base to numbers in another base, different types of equations, trigonometric identities, evaluation and expansion of determinants, binomial expansion, etc , etc

2 Should the form of presentation be linear-paragraph or spatial. Should the form depend on the type of material represented

3. Where should the material be placed on the page.

4. How should steps and operations within the material be aligned What should be done when parts or terms within the material are larger than other terms with which they are aligned and/or compared

5 How should lines and arrows in the material be represented. How should cancellation be represented.

6. When large items or problems need to be carried over to another page where should the material be divided.

   a) Should different types of material be treated differently.

   b) Should the division be indicated

7. What should be done with algorithms which are shown pictorially.

8. Should these problems be considered from the standpoint of education and grade level of the reader.

E. Determinants and matrices.

1. What is the most readable form for these arrays.

2. How should entries in the arrays be treated.

a) Is the present form of left-justifying all entries the most readable and does it adequately cover all conditions.

b) Presently, there are two ways of treating runovers of entries - (1) left justified with line skipped below and (2) indented with no space below. Is only one method needed. If so, which is the best; if not, could conditions of use be specified for each method.

c) Is the present usage of braille ellipses the most discriminable and readable. Provisions are needed for showing vertical and diagonal ellipses.

d) What is the best way of showing cancellation within these arrays.

i) Provisions are needed for showing the cancellation of whole rows and whole columns.

ii) How should vertical cancellation be indicated.

e) How should arrows and other signs of operation within these arrays be shown.

3. How should arrays which are too large to fit on a single page be handled.

a) Where and how should they be divided.

b) Could a keying technique be used for the array and the entries. What would be the best type.

c) Could some of the enclosing or grouping symbols be drawn in rather than using the braille configurations. What would be the best symbols for drawing.

F. Considerable work needs to be done on the readability of tables, their construction and contents.

1. Could tables be classified according to type and could their classification determine how they are displayed, linearly or spatially.

2. What should be done with triangular tables, time tables, multiplication tables, standard reference tables, calendars, etc , etc.

3. Should different rules be developed for volumes of tables compared with books containing only a few tables.

4. What should be done with small tables associated with graphs.

   a) Should they be placed above, below, or to the side of the graph.

   b) Should the table be vertically or horizontally arranged.

5. What should be done with large tables.

   a) Where and how should they be divided.

   b) Should the division be indicated.

   c) Do column headings need to be repeated.

   d) Could facing pages be used.

6. Should there be guidelines for the number of tables which can appear on a page.

7. Where should the table number and title be placed with respect to the table.

   a) Should they appear above, below or both, at the bottom of the page, centered or left justified.

   b) Should there be a space before or after or both.

   c) What should be done with runovers in long titles.

8. Should text material precede or follow a table on the same page What should be done when a table runs across two or three pages and ends halfway down a page.

9. Should the practice of using single and double print lines to separate and distinguish parts or sections of tables be followed when using braille lines. Do the lines have a meaningful function besides that of esthetic appeal. Is their meaning the same in the tactual mode.

10. What is the optimum spacing between columns and between headings and rows Should the spacing vary depending on the grade or developmental level of the reader.

11. What should be done with arrows, lead lines, tracker or tracer lines, lines showing missing data, and cancellation lines.

12. Under what conditions could or should columms and rows be transposed.

13. How should runovers of table entries be treated. Spacing would be a factor in this situation.

14. What should be done with references to footnotes within tables.

G. Exercises

1. For exercises having a number of parts, each with its own instructions, how should this contingency be handled.

   a) Should a space be skipped between the instructions and the exercises.

   b) Where should the two types of material be placed. Should one be indented, if so, which one.

   c) How should runovers of the materials be handled.

   d) What should be done when the instructions for the separate parts all precede the exercises.

2. How should long paragraphs within exercises be treated.

   a) Should they be indented beyond the functional margin; in what cell should they begin.

   b) What should be done with the runovers of the paragraph.

3. What should be done with exercises extending over a number of pages.

4. Should unnumbered or unlettered exercises be placed horizontally or vertically on the page. Sometimes the exercises are graded or ranked in some order - should different types of exercises be treated differently.

5. How should exercises which are numbered or lettered be treated.

   a) Should the designators be at the left-most margin with the material along a functional margin two cells in.

   b) How should short exercises or answers be set-out and designated.

      i) Should they be presented vertically or horizontally, and how should they be numbered or lettered.

      ii) Should different types of exercises be treated differently.

6 How should the answers accompanying problems be arranged and indicated.

a) Should they be positioned and labeled horizontally or vertically.

b) Should the size or length of the answer determine their arrangement.

c) Could guidelines be established for this situation.

d) Where should the answers appearing at the back of books or supplements be placed.

i) Should they be placed at the end of the exercises or the volume in which they occur.

ii) Should a note accompany the exercises telling where the answers are located.

H. Graphs. What should be done with graphs with and without grid lines.

1. Central to their readability is the determination of the values referenced.

2. Another important aspect of their function is the determination of the shape of the curve.

3. What should be included on the graph. How much symbology (lines, points) can be used before readability is impeded.

V. Other Codes and Factors Needing Development.

A. Chemistry - a code is nearing completion in this area. Should it be evaluated for its notation, formats, and rules.

B. Symbology, characteristic graphics, and rules need to be developed for each of the following areas: Physics, Biology, Botany, Zoology, Astronomy, Statistics and Logic.

C. To what extent should codes be developed for the manifold areas of study - numerous new fields of study and endeavor are continuously unfolding. Could some conditions or specifications determine what areas should be encoded in braille.

Braille Codes Pilot Project

Outcome of Endeavors of Computer Committee

I. General Considerations

A. The computer field is relatively new and rapidly changing. Changes are also occurring in the technology and hardware of computers. These factors should be kept in mind when the computer area is considered in connection with the Braille codes.

B. Considering Braille in relation to the computer field there are two general areas of interest - (1) the development of a computer code and (2) the translation of print into Braille by means of the computer.

C. With regard to the development of a computer code and, in general, other codes a number of considerations should be made.

1. Because of the changing nature of the field one of the characteristics of the code should be expansiveness or open-endedness, and explicit provisions for this should be made at the outset.

2. The task of developing a computer code is much too complex for part time efforts; needed are the full time endeavors of personnel hired for the purpose.

3. How will the development of additional codes affect the number of braille readers and transcribers.

4. If more codes and hence a greater variety of materials were available would the number of users of braille increase.

5. Should there be differences in code development, ways of presenting codes, etc. based on grade or developmental levels.

D. In the braille community there are considerable questions about the use of computers in the translation of braille.

1. Regarding the computerization of braille it may be helpful to distinguish between complication and conflict within a code.

a) The former refers to different procedures, rules, or alternative ways of transcribing which are sometimes complex and difficult, but for which conditions of use are specifiable. Involved are valuable techniques, nuances, etc. which should not necessarily be eliminated from the code because of complexity or difficulty.

b) The latter refers to procedures, directives, or rules which do not adequately differentiate under certain conditions and in given situations are incompatible or controvertible. These items should be eliminated from the code.

2. The computer can handle any kind of logical, unambiguous rules or functions for which an algorithm can be written. In practice, however, time and economics impose limits.

3. Some of the rules of the current braille literary code are ambiguous and conflicting. These require subjective judgment by the transcriber and are difficult for the computer to handle.

4. The techniques involved in using the computer to translate print to braille have influenced the literary code and should and will influence the development of codes in other areas. These influences will be of the nature of greater consistency and standardization.

5. Would using key punch machines instead of braillewriters make the transcriber's task easier and possibly encourage more persons to become transcribers.

E. The present project should consider the development of computer and other codes from the standpoint of eliminating the major problems. Fundamental issues should be resolved by whatever means are necessary. The braille authority computer committee considers their work developing a computer code to be interim and temporary. It was performed because something was needed and other resources were not available. Consequently they were willing to work within the limitations imposed by the present systems of braille. Now, however, with the prospect of greater resources more permanent, in-depth solutions should be sought.

F. A major problem in the field of computer codes and in other areas as well has to do with the lack of consistency and compatibility among the codes. Even more pertinent to the computer area is the transcription problem of when to use symbology from the computer code and when to use the symbology of the other codes.

G. An enduring and pervasive problem or question in all of the code areas concerns the degree of equivalence of braille and the ink-print copy.

1. Computer personnel require an exact duplication or isomorphism between the braille transcription and the ink print copy.

2. Those favoring the exact correspondence between braille and print appear to be those whose work or greater knowledge require a closer than average interaction with the sighted or sighted literature. Should there be different contingencies for these two somewhat different groups.

H. The American Printing House for the Blind should take a greater leadership role in the study and production of braille and in effecting changes or innovations in the system.

1. Efforts and attention should be directed toward the production of fewer copies of a greater variety of books.

2. APH should make efforts to broaden its base of production beyond the secondary school level and to produce more scientific and technical literature.

3. Would increasing the present inadequate amount of braille materials for the professionals help to increase the number of braille readers.

4. APH should have a volunteer group of transcribers connected with its operations and should take an active role in directing these groups.

5. Correlatively, the Braille authority or some other group of individual needs to monitor on a frequent or daily basis problems with the codes and changes in print literature and to take immediate action. Procedures for developing and maintaining current standards can be obtained from the American National Standards Institute.

II. The Development of Expanded-cell Codes

A. The rationale for an expanded-cell code

1. Basic to all of the code problems and the computer translation of the codes is the multiplicity of meanings and the equivalence of symbols within and across codes. Many of the braille characters have more than one meaning, and, especially across codes, a number of characters have the same or similar meanings.

a) Related to this is the absence of compatibility of rules, procedures, etc. across codes.

b) Because of these conditions and the overlap of subject areas in texts the problem arises of when and how to use the different codes together. Furthermore, use of the codes together requires knowledge of the various codes and causes difficulty in reading and hand transcribing.

B. Questions and alternatives to an expanded code

1. The variable width system should be investigated and evaluated for (1) the legibility of the characters singly and in combination, (2) the readability of words, phrases, and sentences, (3) the amount of changes required in the existing systems, and (4) its overall feasibility

2. Is an all embracing code desirable from the standpoint of the present Math and Music codes and the material available in these areas, the habits, attitudes and type of the consumer, the possible greater amount of material to be learned, and the equipment and writing devices currently used.

3. Would the variable width code make the existing codes simpler or more complex in terms of symbol units, rules, etc.

4. How would the proposed code affect the number of symbols per line and the amount of material per page. How would tables, charts, etc. be affected.

5. How would the variable width code affect learning to read and reading behavior in the lower grades. What affect would it have in the later grades and on those adventitiously blinded.

6. Inasmuch as the principal source of conflict or problems stems from the relationship between the Math code and the emerging computer code could these differences be resolved and would this constitute an acceptable alternative to the variable width system.

III. The Development of a Code for the Computer Field

A. General

1. The things which need to be considered in developing a computer code are those which have already been reviewed and worked on by the Braille Authority Advisory Committee, i. e. the development of notation, methods for handling special displays, and rules for use of symbols and formats.

a) According to the committee there is nothing especially unique about code development for the computer field except for special symbols and some displays which are not much different from those encountered in other fields.

b) In comparison with some of the other braille codes the computer code has a restricted audience or limited interest and should be considered as a subset of another code, most likely the Mathematics and Science code. On the other hand, the computer code has broad applications and its importance and use will increase considerably in the future.

2. To resolve these problems an overall code containing a large number of symbols is needed to embrace the different subject areas where separate codes now exist.

3. One way to obtain more discrete symbols is through an expanded-cell construction.

   a) In this regard nine-dot braille has recently received some attention, however, the number of available characters in this system is too limited to take care of the vast number of different print symbols.

   b) A more workable system, and one recommended by the committee, is a variable column width construction which is similar to the Standard Dot System proposed by the Uniform Type Committee in 1915 and, with the exception of cell height, the old New York Point System.

      i) With the variable width system there are more than enough discrete symbols to take care of the separate codes which now exist.

      ii) With the proposed system the symbology or notation of the present literary code could remain much as it is, only minor changes being required.

      iii) Where the most change in the present literary code would occur is in the spacing between characters and words. Overall, though, the number of characters per line would be approximately the same. The change in spacing would also require a change in the writing devices: for the braille writers and stereograph machines it would be only a minor modification, for the slates it would be a design similar to that formerly used for New York Point.

      iv) Further, concerning devices and machines, if unambiguous and consistent codes or a code is available then the technology and equipment - writers, reading machines, etc. - will develop.

4. It is also possible that with technological developments something such as interchangeable ratchets on braillewriters would preclude the change in spacing and the literary code would be, for the most part, as it is.

5. To assure an objective consideration of the variable width system the computer committee would like to disseminate examples of the code and to hold a meeting of the other committees and individuals interested in the development of braille.

c) The big problems for the computer code and other codes as well, which have already been mentioned above, are those of deciding when to use the different codes and the multiple meanings and the variant uses of the characters.

2. A listing of some of the more specific problems encountered in developing a computer code follows.

a) In computer manuals two types of alphabets are frequently used to provide different kinds of information, e. g. to show the interaction between the operator and the machine. How should this situation be represented in braille.

b) Relatedly, different print type fonts are used to distinguish between reserve and variable words or expressions in the computer language. How can this distinction be made in braille.

c) In computer materials there are many different forms and uses of capitalization which are important to various operations and functions. This matter needs to be researched in whole and provisions made for its manifold forms.

d) The above three problems are also applicable to the general problem of different type fonts and variant print forms in other areas. (See Textbook area - III E)

e) What portion of text material should use the computer code notation and what parts should use the literary and Math codes notation.

i) It is generally agreed that the listing of programs and displayed coding sheets should be represented in the computer code. Are there other distinctive items for which a certain code can be specified.

ii) What should be done when a computer word or expression is embedded in a different text. Can the conditions be specified under which this situation can be handled. What should be done when computer materials appear in lower level (high school) textbooks.

iii) Should a rule be developed specifying that computer manuals are nonliterary and therefore would use computer notation and punctuation.

3. The different languages in the computer field present different problems with respect to the development of a computer code. Provisions need to be made for these systems.

4. A number of problem itesm which have caused difficulty for the computer in the translation of braille codes have been identified by the Advisory Committee of the Braille Authority and Messrs. Robert Haynes and John Siems of the American Printing House for the Blind. These constitute general kinds of problems or factors to be avoided in the development of a braille code.

B. Computer notation or symbology.

1. The advisory committee has developed braille notation for close to 80 print computer symbols. This list is not exhaustive and the search for other symbols should be continued. The braille representations should also be evaluated for legibility, optimum assignment, etc.

2. For information about symbols which need to be encoded and to determine whether the present notation is adequate an investigation should be made of pertinent publications of the American National Standards Institute, Inc., 1430 Broadway, New York 10018.

3. Because of the large number of print symbols to be encoded many were represented by two-cell braille characters. Do the assignments that were made conflict with the two cell contractions and short form words of the literary, math and chemistry codes.

4. Some of the print symbols have certain structural characteristics which provide information to the reader; should an attempt be made to maintain these characteristics in the braille representations.

5. Since alignment is often important in computer materials, how can it be achieved in light of the fact that some print symbols are represented by one-cell braille characters and others by two-cell characters.

6. Often more symbols per line or a line wider spaced than what is currently used is needed. Could the APH produce a 40 or 41 cell line since the current standard of 38 is primarily a convention.

C. Displays used in computer field.

1. The problems with displays and the displays found in the computer field are not unique. They are reducible to the more basic issue of making two and three dimensional print displays tactually meaningful. However, there are some displays which occur in this field with considerable frequency and for which formatting procedures need to be developed and investigated. Some of these are flow charts, punched cards, decision tables, etc. (See Maps, Charts, Diagrams Area).

a) Most of the displays found in the computer field are currently represented in a tabular form. Could a more meaningful or readable representation be found for these different types of displays.

b) The Braille Authority advisory committee has developed a method for presenting flow charts. So also has the Medcomp Corp. of Cincinnati, Ohio. How do these two approaches compare. Which is more effective and applicable to the range of flow charts found in the computer field. See Appendix B.

c) How can punch cards and their contents be represented in braille. A one-to-one relationship needs to be maintained between the data on punch cards and coding sheets. How can these displays be represented so that the identification of the cards and contents is optimum and the columnar location can be determined.

d) How should tree diagrams be represented. Since order is important in traversing these figures could provisions be made for the different forms of progression.

2. In the production of these figures should a standard method be developed. Is a standard method possible for the different types of media (paper and plastic) and the different production processes (braillewriter, thermoform, and press).

3. To accompany the study of these displays there should be efforts directed toward the development of tools for their production.

IV. The use of computers in translating braille codes.

A. General

1. The prospective or future use of computers in translating all of the braille codes should be a basic consideration to their study and development.

2. It was proposed that in the future computer translation of braille will be commonplace and the answer to the problem of shortrun materials for public school children and other special groups.

3. In developing a program to translate a braille code there are many ways to proceed, however because of production problems which are not necessarily evident in the program phase there should be either a close alliance between the developer and the eventual producer or the producer should develop the program.

B. Problems encountered by computers or transcribers in translating codes.

1. The rules of the literary and other codes need to be examined for ambiguities, inconsistencies, etc., which are non-essential to the functioning of the code, and these factors changed or eliminated. The examination should be made both within and between codes.

2. The advisory committee and computer staff of APH have identified problems and made recommendations to the Braille Authority about difficulties encountered by the computer in translating the literary braille code. These are representative of problem items that would be encountered by the computer in translating any braille code. See Appendix A, Parts 1 and 2. Most of the problems are based on variable use of code elements contingent upon pronunciation, meaning, or position in words, sentences, or lines. To resolve most of these problems human intervention is required.

3. Other problems concern math code functions.

a) To avoid conflict the numerals of all codes should conform to those of the Nemeth code even though this would necessitate the use of special indicators or some changes in the other codes.

b) Use of Nemeth code signs for some mathematical operations was suggested for the literary code. Signs which could be used and require no changes in the literary code are +, -, x, ÷, $, ¢, %, =, and the parenthesis sign.

V. Individuals and organizations working in the computer field.

A. The individuals and developments listed in this section are not meant to be exhaustive, but merely provide a starting point for obtaining information about the area. In addition to the persons listed are those who served on the committee which provided the material for this report.

B. In developing programs for computer translation of braille or determining the potential for such development a number of individuals and organizations have been involved.

1. Mrs. Ann Schack worked on the original IBM 704 program for the Literary code.

2. Mr. John Siems at APH has subsequently worked out an efficient assembly language program for the Literary and Textbook code on the 7040 IBM computer.

3. Mr. Edward Glaser and Dr. Kenneth Ingham have independently worked on Grade 1.8 Braille programs for use on smaller computers. Grade 1.8 is not an official code and is so designated to indicate that fact. This code uses the contractions wherever they occur.

4. The Massachusetts Institute of Technology is working on a Cobal program for good Grade 2 Braille. This program does not have textbook capability.

5. Mr. and Mrs. Joseph Schack conducted a feasibility study of a computer translation program for the Music and Math Codes. Their findings were positive, and they subsequently submitted a proposal for the development of a program to translate the Music Code.

6. Messrs. William Watkins and John Siems at APH are working on a one year project to develop a computer assisted braille music translation program. The project will be completed in the summer of 1972.

7. Mr. Robert Gildea of Mitre Corporation is preparing a project description for the development of a computer translation program for the Math Code.

8. Argonne Laboratories is working on a code system which will operate a reading device. The system is to be complete in that it will read, translate, and provide output.

C. Dr. Charles Hallenbeck at the University of Kansas has developed a program which uses the computer line printer to produce different textured tactile displays.

D. Similarly, Mr. Sam Mason at MIT has developed a computer-controlled device for producing tactile pictures called the "Picture Brailler".

E. For braille output devices a number of organizations and individuals have developed either consoles or computer attachments which produce either modified Grade 1 Braille or a regular Grade 2 Braille. Among them are the Honeywell, IBM, Teletype, and Phylab Corporations, MIT/Mitre, Mr. Ray Morrison and Mr. Guy Carbonneau.

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Braille Codes Pilot Project

Outcome of Endeavors of Maps, Charts, Diagrams Committee

I. General Considerations

A. Over the years there has been little change in the production of maps by publishing houses; only within the past five years, approximately, have new procedures been tried, but, in the main, without a reliable evidential basis

B. On the whole, the principles and laws of visual perception apparently do not apply to tactual perception

1. Compared with vision tactual perception is more restricted, less sensitive to detail, and has more of the quality of serial integration

2. Some material cannot be represented in a way which is tactually meaningful to most readers, e g three dimensional drawings. Other alternatives need to be investigated

3. More information is needed about tactual perception. Principles need to be developed which will define the tactual perception of patterned displays

C. Integral to the study and development of tactual displays is the experiential level of the reader.

1. Affecting the perception of symbology and displays is the reader's developmental age and his previous experience with the symbols and displays.

2. Advancement in this area has been retarded because of the absence of training in reading tactual displays as well as the lack of knowledge of perceptual factors - future work in this area should proceed along the lines of parallel development of these two aspects of reading displays.

D. Inasmuch as most visual maps are generalized or distorted to delineate important landmarks there is no good reason why tactual maps should not be distorted to make them more tactually meaningful.

E. In reproducing tactual displays, principally maps, volunteer transcribers are forced to make decisions about a number of factors which, for the most part, they do not have sufficient information to resolve. Answers to questions such as the following are needed by the transcribers

1. Will the display be tactually readable or meaningful

2. Could it be made meaningful and how

3. How long would it take the reader to interpret and understand the graphic

4. Has the map already been produced and is it available elsewhere

F. In the production of tactual maps consideration should be given to making the maps useable by the partially sighted. In doing this, practices appropriate to the two modalities need to be compatible.

G. There is a need for guidelines for the production of tactual displays, and possibly there should be two sets of guidelines, one for volunteers and one for publishing houses.

H. An outcome of future studies of tactual displays should be a manual or manuals on their production for transcribers and other producers.

I. Consideration should be given to having standard, commonly occuring maps designed and produced by professionals, possibly at a central agency.

J. Surveys, or studies should be made of persons skilled in the production of tactual graphics for a description of symbology, techniques, etc. which they use. Similar studies should be made of skilled users for a delineation of features, relationships, etc. of displays which contribute to readability.

K. Research on tactual displays should be conducted solely from the standpoint of their maximum readability.

II. Perception of symbols

A. General

1. More symbols of different types are needed - efforts should be made to determine what is available and to develop others where necessary.

2. Symbols should be studied individually and in combination:

a) To determine their discriminability.

b) To determine the characteristics or features which make them distinctive.

c) To determine their facilitation or inhibition on the perception of one another.

3. In studying symbology the effects of grade level and developmental factors should be determined

   a) Are some symbols indiscriminable until a certain developmental level is reached

   b) Could different principles be developed for distinct processes at different levels

4. How is the perception of symbols influenced by training at different grade levels

5. Most of the research work on symbols has had to do with their discriminability. Other studies need to be made of the identification and recognition of symbols

6. Studies should also be made of the storage or memorial processes influencing retention of the symbol patterns. What symbols are easily stored or remembered

B. Types of symbols

1. Point, line, and areal symbols which have been found to be discriminable in different studies should be brought together and further study of the discriminability of the larger groups of symbols should be made. Could groups of these types of symbols, discriminable within the groups, be established

2. For optimum legibility how should these symbols be placed in relation to one another. How should they be placed in relation to braille symbology or writing

   a) How does their orientation separately and in relation to other symbols influence their legibility

   b) How much space should separate different types of symbols

   c) How much space should separate intersecting symbols

3. Some symbols or figures are more salient or legible than others, e.g. triangle, square, etc. What are these symbols and could they be ordered or ranked according to their legibility

C. Characteristics of symbols

1. What are the features or characteristics of symbols which made them discriminable, identifiable, and recognizable. Do the features or characteristics vary contingent upon the process involved

2. Symbols can differ in shape or form, size, texture, and height or elevation.

   a) Along one dimension how many absolute discriminations are possible. For combination of dimensions how many discriminations are possible.

   b) Would symbols appearing at different elevations be sufficiently discriminable to be useful in displays. Could an optimum order of types of symbols at varying elevations be established.

   c) Concerning shape or form differences among different types of symbols is there only a small number that can be reliably distinguished from one another.

3. The managed use of redundancy of information in symbols and figures should be studied, e.g., how would encoding symbols by shape and texture influence their elgibility.

4. Can certain figures or forms be perceived as well when represented as an outline as when they are represented as a raised surface. Would the same relations maintain if the line forms and surfaces were of different textures.

D. Functions of symbols

1. Should symbols be collected, developed, and standardized for different purposes.

2. Could different symbols have certain functions relative to the correspondence between their structural characteristics and what they represent.

3. Are some intaglio symbols sufficiently legible to be used in tactual graphics.

   a) Could they be used to represent waterways, rivers, shorelines, etc.

   b) One such symbol which has been used and have proven legibility is the following:

4. Could symbols have conventional functions or assignments across areas or subject matters.

III. Perception of displays

A. General

1. To be able to perceive displays, prior experience with spatial relationships and with elements similar to those of the display is needed. In other words tactual learning and development must be considered. What types of learning and experiences are important to the ability to perceive displays.

2. What are the behavioral tasks of reading displays both from the standpoint of reading and from the standpoint of executing objectives

3. What are the most efficient types of scanning techniques or strategies. Do these depend on the purpose of the reader or task and the type of display

4. To reflect on the important characteristics of displays could correspondences between the mental maps of readers and the displays be determined. What does the reader remember of the display

5. Could different types of displays be classified and studied to determine those which are most readable from which characteristics contributing to readability could be discovered. Could the information which is retrieved be compared with that which is displayed or supposed to be acquired

   a) Visually length, area, and volume of figures within some displays are readable in that order. In what order would these dimensions be read tactually

   b) What are the unique features of each of these dimensions which make them readable

6. The relationships between the figure and ground of tactual displays needs to be studied - the application of visual principles may result in reversing the relationship in the tactual mode

7. What are the variables influencing the perception of organized or patterned displays. Needed are psychophysical studies showing the tactual ability for pattern resolution

   a) What are the conditions for obtaining figural unity in a tactual display - in vision depending on certain relationships elements of a figure hang together

   b) What are the conditions for obtaining figural separation in a tactual display

      i) How does the reader know which elements belong to which figures

      ii) How far separated must figures be before they are perceived as distinct

8. Needed is a consideration or determination of the physical limits of symbols within organized displays - size, number, number of different types, spacing, etc

9. Would the inclusion of reference points and other orientation symbols or devices aid the readability of displays

B. Size

1. What is the optimum size of tactual displays - maps, figures, diagrams, etc. What are the factors which determine that size

   a) Needed are studies of the areal extent of figures from the standpoint of serial perception and subsequent integration

   b) How small could the figures be without violating the requirements for pattern resolution. Are there optimum conditions for this situation

   c) Is there an optimum relationship between size and the amount of information to be conveyed

   d) Is the best size for a display that which is kept within a two-hand span. When reading a display does separation of the hands interfere with distance judgment

   e) How does the size of a display affect the reader's frame of reference

   f) Does the size of a display vary according to the grade or developmental level of the subject

2. Presently maps are produced in large atlases - would they be as readable if they were the size of a braille page

C. Number of complexity

1. Displays should be kept as simple as possible. What is simplicity and how simple should displays be

2. What are the factors which contribute to the complexity of displays

   a) What constitutes an optimum amount of information, number and kind of symbols and number and kind of figures which can be depicted in a display. How many different types of symbols and figures can appear on a display before legibility is affected

   b) What makes a display too cluttered to be readable. This factor should be considered in relation to, or in conjunction with notes, labels, lead lines, tracker dots, etc

c) Is there a developmental or learning factor related to complexity or the amount of information in a display

3. According to cartographers only around five point symbols are needed for a map. Could the numerosity of different types of symbols used in different types of displays be determined

4. A procedure for determining where difficulty is encountered in displays might be to start with simple figures and add on information until performance or readability deteriorates or breaks down

D. Scaling

1. There are two aspects to scaling - one refers to the actual construction, the size-distance relationship between parts of a map and other figure, the second refers to the perception of the time-distance relationship between parts

a) In terms of the first aspect could the value of scaling be determined for different types of tactual graphics, e.g., visual maps are distorted for emphasis

i) What is the significance of scales used

ii) In this sense should scaling in some displays be considered anything more than a general indicator for comparison purposes

iii) What should be done when the scale of a figure has to be changed for braille and operations involving the scale are required to answer questions about the figure

b) Scaling in the second sense is one of the most important aspects of interpreting any graphic

i) What are the factors which are related to the perception of these relationships

ii) What kinds of experiences or training are necessary and related to this ability

2. Tactual scaling needs refinement and development for the following items: thermometers, clocks, rulers, protractors, money - anything comparing or showing the relationship of values

3. Closely related to scaling is oreintation to the placement of figures and orientation to compass directions

a) How should these things be indicated

b) What are the factors which influence or contribute to orientation

IV. Descriptive or explanatory material

A. Where and how should the title, instructions, explanatory material, notes, keys, labels, and compass directions be placed in relation to the display and the page

1. Could the arrangement of these items always be the same; could standard conditions be determined for them. Under what circumstances should they differ

2. Should titles, labels, etc. be placed both vertically and horizontally on the page. In which direction would these items be more readable

3. What kinds of symbols should be used for the compass directions

4. What should be done with leaders from a label to an indexed part. Could conditions be determined under which they would improve readability

5. Does labeling or other extraneous symbology within a textured area cause confusion in perceiving the area

6. Key placement

a) In arranging the key symbology consideration should be given to whether their orientation is the same as used on the display. How would a change of orientation influence the perception of the symbols

b) In multi-sectioned displays or displays running across more than one page, should the key appear only once or be repeated for each section or page

B. Under what conditions should number and letter signs be used. Should they be used at all. There are different practices of using these symbols - should their use be standardized

C. How should different ink colors and shading be represented

1. What should be don with different saturations of hue

2. Could different textures be used for shading

V. Training for reading displays

A. Children need to be taught to systematically explore tangible displays. For efficient performance children need to develop strategies for exploring displays

B. Children need to be taught a wide variety of spatial relations. Are some types of tasks and materials better than others for achieving an appreciation of spatial relations.

C. Readers need to be taught the concepts and practices of scaling and these related to the child's actual experiences.

D. What do teachers think are important features of displays and aspects of reading displays which need to be taught. Could an assessment or survey be made of teacher's interpretations of these things.

E. Training to read displays should be gradual and should increase in complexity as grade level or age increases.

F. In terms of skills, principles, and techniques what would be appropriate for training teachers in the area of reading displays.

G. Should manuals for reading displays be developed for teachers and students.

H. One area where displays and training for reading displays is critically needed is that of Orientation and Mobility. Here maps are needed for different grade or developmental levels.

VI. Classification of displays.

A. General

1. Would the classification of displays and maps provide information which would be relevant to perception. Could the kinds of information displays are supposed to contain be classified.

a) Do the types and characteristics of displays interact with characteristics of tactual perception or other characteristics of readers.

b) For classification of different types of maps see Robinson and Sales - Elements of Cartography. Could base maps be prepared for different types of commonly occurring maps.

c) Should certain types of maps contain information based on certain principles or purposes for which they will be used, such as specific utility, e g. in a layout of a floor plan for a building show only main corridors, directions, stairs, and their direction, location of important offices and restrooms.

d) What displays are easiest to read both between and within classes and what are the factors contributing to their readability.

B. Different types of displays. The following are not exhaustive but simply the ones considered by the committee. For other examples and considerations see the Textbook and Math areas.

1. Biological and Botanical drawings. These need classification and some should probably not be attempted at all, others could be treated with cross sections and graphs.

2. Circles and pie diagrams.

   a) To make the comparison of areas of circles visually accurate, the circles need to be corrected by a predetermined amount. Would this also be true for the tactual mode.

   b) How should they be divided in order for the divisions to be tactually readable.

   c) Could circles be used to develop the concept of degrees of angularity. Is this an efficient means of teaching degrees in angles.

3. Clock faces and thermometers, both actual devices and representations.

   a) The main problem with these devices is that of comparing a moving point with a fixed position or positions.

   b) What is the optimum space between the pointer and the index number.

   c) What is the optimum space between the index numbers.

   d) What is the optimum length of hands which will allow them to be differentiated.

   e) In studying these devices should a distinction be made between static teaching models and dynamic actual models. Different considerations need to be made for circular and bar type thermometers.

4. Crosscuts or cross sections.

   a) For example, biological or geological - these types of figures should be considered or treated with line graphs.

   b) Would overlays or serial drawings depicting different features of the same object be an efficient means of representing these figures.

5. Economic charts. What could be done with cartograms in which pictures of actual objects are used to show the function. Should other symbols be substituted for the figures.

6. Electrical or electronic schematics.

   a) Symbology and uniform method of representing are needed.

   b) Would outlined blocks enclosing symbols which have been keyed be an effective means of representing.

   c) Would a narrative description of the schematic be as meaningful as a spatial representation.

7. Flow charts.

   a) Do the different kinds of flow charts present different problems.

   b) Should special symbols be developed and standardized for boxes, slopes, directional lines, branching, etc.

8. Graphs, bar and curve.

   a) Three principle problems are the detection of the slope of a line, the relationship of values or classes of values, and the referencing or determination of values. What are the variables which influence these functions.

   b) Could standards be developed for setting up the axis lines of graphs. For a series of graphs would maintaining the same basic axes contribute to readability.

   c) For bar graphs is the outline form as readable as a raised surface bar. What about straight lines as substitutes for the bars.

   d) Is there an optimum elevation and spacing of cross hatching and leader lines which would not interfere with the legibility of the graph.

   e) Would alternative ways of presenting the information in some graphs, e.g. tabular format, be more efficient. Under what conditions.

9. Pictures, figures, and photographs of objects.

   a) What should be done with items of this nature which cannot be reproduced. Should they be described. If so, is the description and vocabulary level adequate.

b) Should an attempt be made to develop tactually readable, simple embossed pictures and shapes of commonly occurring objects

c) What should be done with pictures and drawings that figure into different types of operations and functions within the text, e.g. in math, counting pictures of elephants, cowboys, etc.

d) Should different procedures for handling these materials be developed for different grade levels.

10. Rainfall maps

a) Would different textures and density of patterns adequately depict the information involved.

b) Could different symbols be used for different types of information.

11. Time lines

a) Two sources of difficulty with these figures are referencing time values and overlapping time periods. What could be done about these problems.

b) Could different degrees of line symbol legibility be used to depict different time periods. This would require scaling of line symbols.

c) How should direction of time lines be represented.

VII. Production

A. What are the principles on which transcribers and others rely to produce displays.

B. In terms of faithful reproduction of the object or event, how accurate does a display need to be to convey the desired concept.

1. Could features of displays be distorted to emphasize important information.

a) Would distortion result in a more accurate percept.

b) Would it lead to the desired percept more quickly.

c) Under what conditions should it be used.

2. When would generalizing (excluding insignificant detail and elaborating important elements) of displays be useful. Under what circumstances should it be used; for what purposes.

C. Would serial drawings depicting different features of the same display improve its readability. Is the reading of displays divided into sections more difficult than reading the whole display.

1. Is the skeleton procedure (presenting a bare outline of the whole display and subsequently elaborating subsections) an effective means of representing displays.

a) How should the skeleton be divided - would quadrants be the most desirable.

b) Should the complete display accompany the skeleton. Where, before or after.

2. In partitioning displays would it be better to add or subtract layers of complexity. Should the whole figure precede or follow or come before and after the partitioning.

3. Would these procedures produce the same effects on subjects at different grade or developmental levels.

D. Could methods be worked out for representing three dimensional objects or figures in a two dimensional tactual space. Are there current methods for doing this and how effective are they.

E. What considerations should be made regarding multi vs. single copy reproduction and the different types of media on which the displays are produced - plastic and paper.

1. Should there be different principles of production for these different conditions. Should the production process depend on these variables.

2. Are there certain types of materials which are best for certain types of displays.

3. For different types of media such things as the following should be considered: capacity for texturing, ability to hold the pattern, strength of pattern, longevity of material.

4. Do different types of symbols need to be developed for the different media. Could certain of the same symbols be used across the different media.

F. Could the use of symbols be standardized. For different types of displays.

1. Are there a sufficient number of symbols to standardize.

2. Could production conventions for the use of symbols be developed.

3. Would standards produce limitations on the use of symbols and the production of displays.

G. Could overlays and facing pages be used and be tactually meaningful.

H. Tools need to be developed for discriminable symbols and the production of displays.

1. Should they be standardized for different types of production processes, for different types of material.

2. Would a plate or template for drawing against be useful in conjunction with some of the tools.

3. Would computers be useful or have any application in the production of tactual graphics.

4. Can the tools be produced economically, can they be made on a production basis.

VIII. Individuals and organizations involved in the study and production of displays.

A. The following items are not exhaustive of the many individuals and organizations working in this area. They are references adduced during the committee meetings. As references they furnish a good starting point for investigating the area. Naturally, heading the list are those individuals who served on the committee and provided the substance for this report.

B. Dr. Alfred Leonard at the University of Nottingham has studied the physiological correlates and behavioral tasks involved in using maps for traveling.

C. Dr. W. James Pickles, Worcester College for the Blind, has done considerable work on training to read maps.

D. Mr. Robert Gunderson, New York Institute for the Blind, is skilled in the production and use of electrical schematics and Morse Code.

E. Mr. Carlton Martin, Wichita, Kansas, has designed and developed embossing tools for Mrs. Betty Epstein, a volunteer map transcriber.

F. Rand-McNally has published a map reading training text for teachers and one for students.

G. The Army Topo Command, Washington, D. C., has done considerable research on maps and work on the production of maps - equipment, materials (the latest in plastics) and techniques. This organization may have available pantographs which would be useful in the production of maps for the blind.

H. Expandocraft paper made by the Scott Paper Company allows greater elevation of symbols and may be useful in the construction of displays.

I. Tedlar PVF film is a thin sheet of plastic on which one can mark and obtain a raised image on the same side of the sheet as that on which marked.

J. The Massachusetts Institute of Technology has worked with a chemical process for etching plastic which reportedly results in a very legible tactual graphic.

K. The Howe Press, Royal National Institute for the Blind, and Recordings for the Blind have all wroked on and produced tool kits for the production of tactual displays.

Appendix D

Generalized Problem List

The following report is the result of an attempt to bring together and relate problems and issues from five areas where work on braille codes is necessary. The first section contains general considerations brought up by committee members in each of the areas. No attempt was made to indicate the areas in which the issues arose. In subsequent sections, 2.0 through 5.0, individual problems are specified and the areas to which they relate are indicated. The indicators are found to the right of the problems in any of three columns. The columns are headed by letters which refer to the following areas: TF - Textbook Format, Mu - Music, M & C - Mathematics and Computer. Within the M & C category most of the items are from the math area. To distinguish these from ones in the computer area, the fewer number of computer items are preceded by COM. Also included in this category are a very few items from the Maps, Charts, and Diagrams area. These are preceded by the word, Maps. The symbols found under these headings refer to problem items in certain sections of the committee reports for each of the areas. The committee reports were set up in a standard outline form using Roman numerals, letters, and numbers.

Braille Codes Pilot Project

1.0 General Considerations

.1 Common across areas

.11 Philosophy of transcription
.12 Considerations basic to problems
.13 Modification and development of codes and techniques
.14 Editing
.15 Considerations pertinent to transcribing
.16 Considerations involving computers
.17 Manuals and guidebooks
.18 Considerations concerning the American Printing House for the Blind
.19 The development of an overall code of braille

.2 Specific to areas

.21 Textbook Format
.22 Mathematics and Science Area
.23 Music Code
.24 Computer area: code development
.25 Maps, Charts, and Diagrams area

2.0 Problems of Symbols and Rules Involving Symbology

.1 Review of symbology and conditions of use
.3 The representations of symbols
.4 The placement, arrangement, or alignment of symbols
.5 Other symbology needed

3.0 Formats and Linear Displays

.1 Formats

.11 Formats for different parts of a book
.111 The cover and volume identification
.112 Title pages
.113 Indices
.114 Appendices
.115 Glossaries

.12 Formats for page variations
.121 Pagination
.122 Numbered and lettered lines including those which are to be counted or otherwise reckoned and measure numbering
.123 Page titling and key and time signatures
.124 Alignment and juxtaposition of materials
.125 Runovers, word and measure division
.126 Margins
.127 Footnotes, references, marginal information, and glosses
.128 Transcriber's notes
.129 Variant type forms and print devices for emphasis

.1291 General considerations
.1292 Different print type fonts
.1293 Italics
.1294 Double caps
.1295 Underscoring
.1296 Paragraph headings
.1297 Colored type
.1298 Miscellaneous designata

.13 Formats for Language and Special Materials
.131 Systems of pronunciation, pronunciation marks, and punctuation
.132 Plays
.133 Poetry
.134 Foreign languages

.2 Linear Displays

.21 General
.22 Types of displays and their placement
.23 Modification and alteration of displays
.24 Titles, headings
.25 Designators, indicators
.26 Spacing
.27 Alignment
.28 Margins, identations
.29 Runovers, division of materials
.30 References, footnotes
.31 Enclosures, explanatory materials, entries
.32 Techniques and miscellaneous

4.0 Non-linear Displays

5.0 Factors Needing Development

.1 Complete codes
.2 Symbology, format, and rules
.3 Displays
.4 Special factors needing development
.5 Music materials needing development

6.0 Resources

Braille Codes Pilot Project

1.0 General Considerations

.1 Common across areas

.11 Philosophy of transcription.

Some of the items within this report are posed as questions, some as statements, all represent considerations or judgments by members of the committees about what needs to be done to improve braille and the plight of the braille reader. Not all of the considerations were introduced by committee members in all of the areas but occurred with greater or lesser frequency. Those items under general considerations are not designated according to the area from which they came. The ones under the more specific problem sections are so designated, and an attempt was made to generalize the items across areas. To determine the exact problem for a given area, it is only necessary to refer to the committee meeting for that area.

The items included in this subsection are not the only ones which are pertinent to a philosophy behind the translation of print to braille. Many of the considerations and questions from other of the subsections below are also applicable. The reason for singling out the ones in this section was that so many of the problems listed later had their origins or solutions linked to them.

.111 An enduring and pervasive issue in all of the code areas concerned the degree of equivalence of braille and the ink print copy or, in other words, isomorphism versus divergence. This issue arose in all of the areas, and those from the computer and math fields favored the exact correspondence.

.1111 Empirically those favoring the exact correspondence were those whose work was technical or such that required a close interaction with the sighted or sighted literature. Should different contingencies be considered for these somewhat different groups.

.1112 In what ways is it important for the student to know how the print format appears. Should a grade level factor enter into this question.

.1113 What considerations relevant to the equivalence issue should be made regarding visually handicapped students in public schools.

.112 Another factor arising in a number of the areas, albeit at times only implicitly,concerned the unit of recognition in braille reading. It was apparently assumed that this unit was the whole word, and that braille reading occurred in a manner similar to print reading. The effects of this assumption on the codes are the establishment of rules and practices whose purpose is to maintain the integrity of the whole word. However, research has indicated that the unit is the individual character which along with the other characters in a word is sensed in a spatial-temporal sequence. These results have implications for the use of contractions in words and the division of words.

.113. Another issue which arose in all of the areas was that space saving is no longer the important consideration it once was, and now greater emphasis should be placed on the readability of braille.

.114 One further item for consideration was that an attempt be made to determine the tactual meaningfulness of changing print practices, and that research and changes of the code should be based on maximum readability.

.12 Considerations basic to the problems.

.121 Overall the principles and laws of visual perception do not apply to tactual perception.

.1211 Compared with vision tactual perception is more restricted, less sensitive to detail, and has more of the quality of serial integration.

.1212 Some material cannot be represented in a way which is tactually meaningful to most readers, e.g. three dimensional drawings. Other alternatives need to be investigated.

.1213 More information is needed about tactual perception. Principles need to be developed which will define the tactual perception of patterned displays.

.122 Integral to the study and development of braille and tactual displays is the experiential level of the reader.

.1221 Affecting the perception of symbology and displays is the reader's developmental age and his previous experience with the symbols and displays.

.1222 Advancement in this area has been retarded because of the absence of training in reading tactual displays as well as the lack of knowedge of perceptual factors - future work in this area should proceed along the lines of parallel development of these two aspects of reading displays.

.123 A major problem in all the areas has to do with the lack of consistency and compatibility among the codes. Of possibly even greater significance is the transcription problem of when to use the symbology of one code and when to use the symbology of the other codes.

.124 In planning or considering codes for different fields some variables are common across all fields - vertical and horizontal factors. An attempt should be made to make codes compatible horizontally or where they share commonalities and avoid having different symbols for the same or similar situations. This requires the determination of common elements. Would a computer be useful in listing or keeping track of instances where symbols or rules are used.

.125 The present project should consider the development of computer and other codes from the standpoint of eliminating the major problems. Fundamental issues should be resolved by whatever means are necessary. With the present prospect of greater resources more permanent, in-depth solutions should be sought.

.126 In dealing with the problems a useful distinction may be that between format problems and problems of linear and non-linear displays. The latter problem types refer to relationships of parts internal to an item such as a table or graph, and the former refers to relationships of the text to the page and to other items on the page. This distinction is followed later in the sections dealing with the more specific problems.

.127 Decisions concerning problems in the present code should be made in light of eventual computerization and standardization of practice. On the other hand, any changes in the code should be made from the standpoint of the reader and a workable code and not ease of computerization.

.13 Modification and development of codes and techniques.

.131 The present practices and rules of the codes need to be examined and evaluated, and the inconsistencies within and across codes eliminated.

.132 Within a code some of the symbolism may be deleted but there is a question of whether or not new meanings should be assigned to the characters formerly used.

.133 Format techniques and rules should be looked upon only as guidelines which may change with future developments.

.1331 Practices and rules should be kept current with changing print practices.

.1332 Maintaining currentness is an ongoing process and requires continuous monitoring of print and liaison with print publishers.

.134 Because of the changing nature of different subject areas and print practices one of the characteristics of a code should be expansiveness or open-endedness, and explicit provisions for this should be made at the outset.

.135 In code development and in the exposition of codes there is a question of whether differences based on grade or developmental levels should be considered.

.1351 How could the difficulties caused by the beginning reader having to learn different forms of the same word be resolved.

.1352 Could the introduction of code elements be controlled and possibly based on frequency of occurence.

.1353 Should attention be given the fact that public school children often have no one available to interpret the symbols, formats, rules, etc.

.136 Should there be two levels or grades of braille, one for the multi-handicapped or retarded and one for the average visually handicapped, viz, grade 1 1/2 and grade 2 for the respective groups.

.137 The task of developing a code is much too complex for part time efforts; needed are the full time endeavors of personnel hired for the purpose.

.138 A number of problem items which have caused difficulty for the computer in the translation of braille codes have been identified by the Advisory Committee of the Braille Authority and Messrs. Robert Haynes and John Seims of the American Printing House for the Blind. These constitute general kinds of problems or factors to be avoided in the development of a braille code.

.14 Editing

.141 Editing is principally a format problem, and editors and transcribers vary in their knowledge of the code and their practices of formating.

.142 Editing entails a decision of what should be reproduced. Who should make this decision and on what basis. What kind of editing is useful or desirable.

.1421 How would editing affect transcribers. They do not want or feel qualified to decide what should be deleted or changed.

.1422 Should teachers edit the books before they are transcribed. Relatedly, could procedures be worked out for transcribing both parts or sections and the whole of a book.

.1423 Would joint teacher-transcriber editing be feasible and resolve some of the problems inherent in the process.

.143 Should grade level considerations enter into this matter. Should an attempt be made to determine what the regular class teacher of the lower grades, K-4, requires and expects of the blind child with regard to the use of the material in print books. How much is meaningful and used by the resource or itinerant teacher. Could information of this type provide the basis for editing lower level math books.

.15 Considerations Pertinent to Transcribing

.151 It is generally accepted that transcribers prefer not to have to decide the resolution of ambiguities and the determination of format. Inasmuch as the transcribers annually produce more titles than any other organization this consideration should be central to any future work on the codes.

.152 Under what conditions should transcribers list special symbols and symbols of other codes in the front of a book.

.1521 What should the transcribers do if they don't know the other codes.

.1522 Would it be desirable to determine the most commonly used special symbols by grade level.

.1523 On the assumption the reader knows the other codes could just a transcriber's note be used specifying the other codes which appear in the book. Should different types or levels of books be treated differently.

.153 In reproducing tactual displays, principally maps, volunteer transcribers are forced to make decisions about a number of factors which, for the most part, they do not have sufficient information to resolve. Answers to questions such as the following are needed by the transcribers.

.1531 Will the display be tactually readable or meaningful.

.1532 Could it be made meaningful and how.

.1533 How long would it take the reader to interpret and understand the graphic, and would the effort be justified.

.1534 Has the map already been produced and is it available elsewhere.

.154 Would using key punch machines instead of braillewriters make the transcriber's task easier and possibly encourage more persons to become transcribers.

.16 Considerations Involving Computers.

.161 Computers are playing an increasingly important role in the production of literary braille and have a prospectively useful role in the production of music and math braille. Any future work on these codes or the development of new codes should focus on this contingency.

.162 The computer field is relatively new and rapidly changing. Changes are also occurring in the technology and hardware of computers. These factors should be kept in mind when the computer area is considered in connection with the Braille codes.

.163 Considering Braille in relation to the computer field there are two general areas of interest - (1) the development of a computer code and (2) the translation of print into Braille by means of the computer.

.164 In the braille community there are considerable questions about the use of computers in the translation of braille.

.1641 Regarding the computerization of braille it may be helpful to distinguish between complication and conflict within a code.

.16411 The former refers to different procedures, rules, or alternative ways of transcribing which are sometimes complex and difficult, but for which conditions of use are specifiable. Involved are valuable techniques, nuances, etc , which should not necessarily be eliminated from the code because of complexity or difficulty.

.16412 The latter refers to procedures, directives, or rules which do not adequately differentiate under certain conditions and in given situations are incompatible or controvertible. These items should be eliminated from the code.

.1642 The computer can handle any kind of logical, unambiguous rules or functions for which an algorithm can be written. In practice, however, time and economics impose limits.

.1643 Some of the rules of the current braille literary code are ambiguous and conflicting. These require subjective judgment by the transcriber and are difficult for the computer to handle.

.1644 The techniques involved in using the computer to translate print to braille have influenced the literary code and should and will influence the development of codes in other areas. These influences will be of the nature of greater consistency and standardization.

.17 Manuals and Guidebooks

.171 There is a need for a manual of format and techniques for each of the codes. Present manuals need to be examined for completeness of coverage, errors, ambiguities, etc.

.1711 The manuals should be cross referenced and specify priorities of rules and codes which take precedence.

.1712 Would grade level or another type of ordered guidelines be desirable for the introduction of contractions and other difficult symbols.

.1713 Should separate rules or guidelines be developed for students and teachers.

.172 The present code books need more directions and greater specificity of rules and guidelines. Also needed are more varied and complex types of examples. This material could be placed in a supplement or addenda and cross referenced with the code book.

.173 There is a need for a manual of guidelines for the production of tactual displays, and possibly there should be two sets of guidelines, one for volunteers and one for publishing houses.

.174 Should lesson books for the codes be developed for teachers. Would it be desirable to present the codes on the basis of what is needed at certain levels.

.175 The American Printing House for the Blind has recently completed a 1970 Addendum to the Code of Textbook Formats and Techniques.

.18 Considerations concerning the American Printing House for the Blind (APH)

It is understood that many of the current policies and operations at APH have their origin in past federal legislation. For this

reason some of the considerations below could not be implemented at this time. However, committee members felt that these suggestions would be beneficial to the field, and that they should be included in the report for future examination and action.

.181 There was general agreement that APH should assume a leadership role in the development and standardization of the braille codes, in effecting changes or innovations in the codes, and in assuring the future production of braille.

.1811 Efforts and attention should be directed toward the production of fewer copies of a greater variety of books.

.1812 APH should make efforts to broaden its base of production beyond the secondary school level and to produce more scientific and technical literature.

.1813 APH should have a volunteer group of transcribers connected with its operations and should take an active role in directing these groups.

.1814 Correlatively, the Braille authority or some other group or individual needs to monitor on a frequent or daily basis problems with the codes and changes in print literature and to take immediate action. Procedures for developing and maintaining current standards can be obtained from the American National Standards Institute.

.182 APH has embarked on a project to develop a computer assisted music translation program. The initial phase of the project runs from May 1971 to June 1972.

.183 Over the past two years APH has developed a braille Chemistry code which is compatible with the present Mathematics Code.

.19 The Development of an Overall Code of Braille.

.191 The rationale for an expanded-cell code.

.1911 Basic to all of the code problems and the computer translation of the codes is the multiplicity of meanings and the equivalence of symbols within and across codes. Many of the braille characters have more than one meaning, and, especially across codes, a number of characters have the same or similar meanings.

.19111 Related to this is the absence of compatibility of rules, procedures, etc. across codes.

.19112 Because of these conditions and the overlap of subject areas in texts the problem arises of when and how to use the different codes together. Furthermore use of the codes together requires knowledge of the various codes and causes difficulty in reading and hand transcribing.

.1912 To resolve these problems an overall code containing a large number of symbols is needed to embrace the different subject areas where separate codes now exist.

.1913 One way to obtain more discrete symbols is through an expanded cell construction.

.19131 In this regard nine-dot braille has recently received some attention; however, the number of available characters in this sytem is too limited to take care of the vast number of different print symbols.

.19132 A more workable system, and one recommended by the committee, is a variable column width construction which is similar to the Standard Dot System proposed by the Uniform Type Committee in 1915 and, with the exception of cell height, the old New York Point System.

.191321 With the variable width system there are more than enough discrete symbols to take care of the separate codes which now exist.

.191322 With the proposed system the symbology or notation of the present literary code could remain much as it is; only minor changes being required.

.191323 Where the most change in the present literary code would occur is in the spacing between characters and words. Overall, though, the number of characters per line would be approximately the same. The change in spacing would also require a change in the writing devices: for the braille writers and stereograph machines it would be only a minor modification, for the slates it would be a design similar to that formerly used for New York point.

.191324 Further, concerning devices and machines, if unambiguous and consistent codes or a code is available then the technology and equipment - writers, reading machines, etc. - will develop.

.1914 It is also possible that with technological developments something such as interchangeable ratchets on braillewriters would preclude the change in spacing and the literary code would be, for the most part, as it is.

.1915 To assure an objective consideration of the variable width system the computer committee would like to disseminate examples of the code and to hold a meeting of the other committees and individuals interested in the development of braille.

.192 Questions and alternatives to an expanded code.

.1921 The variable width system should be investigated and evaluated for (1) the legibility of the characters singly and in combination, (2) the readability of words, phrases, and sentences, (3) the amount of changes required in the existing system, and (4) its overall feasibility.

.1922 Is an all embracing code desirable from the standpoint of the present Math and Music codes and the material available in these areas, the habits, attitudes, and type of the consumer, the possible greater amount of material to be learned, and the equipment and writing devices currently used.

.1923 Would the variable width code make the existing codes simpler or more complex in terms of symbol units, rules, etc.

.1924 How would the proposed code affect the number of symbols per line and the amount of material per page. How would tables, charts, etc. be affected.

.1925 How would the variable width code affect learning to read and reading behavior in the lower grades. What affect would it have in the later grades and on those adventitiously blinded.

.1926 Inasmuch as the principal source of conflict or problems stems from the relationship between the Math code and the emerging computer code could these differences be resolved and would this constitute an acceptable alternative to the variable width system.

.2 Specific to Areas

.21 Textbook Format

.211 Problems in the textbook area revolve primarily around format practices and rules.

.22 Mathematics and Science Code.

.221 At the elementary level teachers feel that the math code is too complex and that more time is spent working with the code than with the math concepts.

.2211 Some code elements may interfere with the concepts being taught, e.g. work with square figures often does not occur until the third grade but the symbol for the square is introduced in the first grade How does this situation influence the child's concept of a square.

.2212 Could the code be simplified for elementary level students. Would a graded teaching manual alleviate some of the difficulties with the code encountered by the young child Should math series be surveyed for introduction of symbols and concepts and the results used as a basis for the introduction of symbology. Would changes in subject structure or curriculum affect the manuals.

.222 A recent revision of the math code has been made but it has left unattended a number of items which should be included in the code. A review of the code is needed to determine what is missing and what should be included.

.223 Absence of official adoption of the Math Code has been considered partly responsible for the few number of volunteer transcribers in this area.

.224 Eventual certification of math transcribers presumably by the Library of Congress is anticipated.

.23 Music Code

.231 The exact duplication of inkprint copy results in the representation of some unnecessary symbology and material in braille, e.g. clef signs and parentheses Could conventions be established for what should be included in braille. Should a grade level or a beginning music level factor enter into what is represented in braille.

.232 In print music there are different ways of depicting the score; also there are anomalies peculiar to a composer or autographer, and sometimes the text contains errors What should be done with these things - should the anomalies and errors be changed; should standard guidelines be developed and specified for these variables.

.233 There are a number of different methods of presenting braille music, e.g. bar over bar, line over line, etc. whose use is determined by considerations based on the music.

.2331 Can the conditions under which these methods are used be specified and listed.

.2332 Should one method be preferred to another Could the best method be determined.

.23321 Should bar over bar be used in preference to line over line for simple and elementary music.

.23322 Should line over line be used more often Under what conditions.

.234 The reading of intervals for solo instruments in the trebel clef and orchestral scores varies - solo read downwards and orchestral read upwards.

.2341 Which is the best method of reading.

2342 With the exception of keyboard music why couldn't all intervals be read upward

235 The braille representation of the more complex music requires stylistic and interpretative decisions which will be difficult for the computer to handle

236 The computerization of braille music will lead to a more standardized reproduction than was heretofore possible

24 Computer Area. Code Development

241 The things which need to be considered in developing a computer code are those which have already been reviewed and worked on by the Braille Authority Advisory Committee, i e the development of notation, methods for handling special displays, and rules for use of symbols and formats

242 According to the committee there is nothing especially unique about code development for the computer field except for special symbols and some displays which are not much different from those encountered in other fields

243 In comparison with some of the other braille codes the computer code has a restricted audience or limited interest and should be considered as a subset of another code, most likely the Mathematics and Science code On the other hand, the computer code has broad applications and its importance and use will increase considerably in the future.

244 The big problems for the computer code and other codes as well, which have already been mentioned above, are those of deciding when to use the different codes and the multiple meanings and the variant uses of the characters.

245 What portion of text material should use the computer code notation and what parts should use the literary and Math codes notation.

2451 It is generally agreed that the listing of programs and displayed coding sheets should be represented in the computer code Are there other distinctive items for which a certain code can be specified.

2452 What should be done when a computer word or expression is embedded in a different text Can the conditions be specified under which this situation can be handled What should be done when computer materials appear in lower level (high school) textbooks.

2453 Should a rule be developed specifying that computer manuals are nonliterary and therefore would use computer notation and punctuation.

246 The different languages in the computer field present different problems with respect to the development of a computer code Provisions need to be made for these different systems.

.25 Maps, Charts, and Diagrams Area

.251 Over the years there has been little change in the production of maps by publising houses; only within the past five years, approximately, have new procedure been tried, but, in the main, without a reliable evidential basis.

252 Consideration should be given to having standard, commonly occurring maps designed and produced by professionals, possibly at a central agency

253 Inasmuch as most visual maps are generalized or distorted to delineate important landmarks there is no good reason why tactual maps should not be distorted to make them more tactually meaningful.

254 In the production of tactual maps consideration should be given to making the maps useable by the partially sighted. In doing this, practices appropriate to the two modalities need to be compatible.

	TF	MU	M & C
2 0 Problems of Symbols and Rules Involving Symbology			
.1 The use of much of the symbology of the different areas needs to be reviewed. Coincident with the review should be a specification of the conditions under which the symbols are used. Answers to many of the questions below should be sought in the review.	IIE,G		
.11 Are the items which the symbols represent sufficiently defined to delimit or specify the invariant use of the symbols			IIH2
.12 When should the symbols be used.		IIA1,B1, IIIL3	
.13 How is their use influenced by different types of material	E,F		
.14 How frequently are the symbols used	C,F1		
.15 If used infrequently should they be eliminated	C,F1,G1		
.16 Is what the signs represent meaningful or significant in terms of distinctive information imparted.		IIF1	
.17 If the information is not distinctive or is unnecessary could the symbols be eliminated.		F1	
.18 If eliminated should other meanings be assigned to the characters.	F2		
.19 Under what conditions should the symbols be used in various language forms, e g prefixes and suffixes	E1,2	B3,I	
.20 Could the use of the symbols be the same in all words and content within a given area.	E,E3,F		
.21 Under what conditions should special or clarifying symbols accompany other codes		IIF2,H4	D,E
.22 What effects will revisions or changes in the symbology and rules have on other parts of the code and on other codes			A2,D
.23 Should the readability of certain symbols singly and together be determined.		C1,D1, H1,2	
.24 Should a standard list of special symbols and forms be prepared, e.g abbreviated words and measurements.	G2		
.25 Are the rules for use clear, unambiguous and complete	E	A1a,H1, H2,H4	

	TF	MU	M & C
.26 Should certain operations or transpositions implied by the symbols or content be made for the reader by the transcriber.		F3	
.27 What are the effects of grade level on the use of symbols, or, in other words, what considerations should be made about grade level and the use of symbols	G3	J	
.3 What should be done about different symbols representing the same things within and across codes.			
.31 Should the characters or signs be the same.	A		A1
.32 Under what conditions and for which code elements.	B		C
.33 Do and should symbols within a code always mean the same things	E3		B,H
.34 What should be done about variable print practices of using the same symbol in different ways.			G1,2,H,1
.35 Is the meaning of the different print representations the same			G1
.4 What should be done about the placement, arrangement, or alignment of symbols together and with other materials			IIF Com IIIB5
.41 What are the most readable ways of using certain symbols together		IIB4,C1, E,G2,H2 III 1 G1,H3	Com IIIB3
.42 How do they best represent the print expression			
.43 How does their disposition best preserve the character of the material.		IIA1b	IIF Com IIIB4
.44 What should be done when the material in question is carried over from one line to another or one page to another.		B2,D2, H1	
.45 What should be done about "floating dots," the condition in which the relationship among dots in two or more cells makes the level of some of the dots difficult to determine or in other ways causes loss of alignment or orientation to the characters. These configurations are especially difficult for the young child. Could a special indicator or re-reference sign be developed		D,B	B5,K4
.46 Are there grade level considerations which should be made regarding these questions.	D		
.5 Symbology or notation is needed to represent new, special, or currently undepicted print symbols in some of the existing codes.	H,I	K2,3,5	II 11,2,3, Com IIIB1

	TF	MU	M & C
51 Are the print sumbols sufficiently invariant and widely recognized and agreed upon			II IIa
.52 Should braille or some other signs be used to represent the print symbols			II IIb Com IIIB4
53 In the music area a representation is needed showing when two fingers or two hands are to perform some action		IIIH, IIIK1	
3 0 Formats and Linear Displays			
.1 Formats			
.11 Formats for the different parts of a book			
.111 The cover and volume identifcation			
.1111 Where on the cover is the best place to identify or title a braille volume. Where would the title be most readable and accessible	IIIA1a,b		
.1112 In which direction should the title run - horizontally or vertically	1c		
.1113 What information should be included along with the title. Could the Arabic numerals be substituted for the Roman for the volume number on the binding	1d		
.1114 Should there be different ways of titling different types of books or books produced by press and those produced by braillewriter. Guidelines are needed for both braille and print title pages	1e		
.112 Title pages			
.1121 What is the best format for the title pages. Where should the material be placed on the page. Should it all be left - justified	A2a		
.1122 Should different items of information be included for different types of material, e g. the initial letters of words contained in a volume of a dictionary	2b		
.113 Indices			
.1131 Are indices in their most readable form	A4a		
.1132 Should the index terms be fully capitalized or italicized when they appear as such in print.	4b		

		TF	MU	M & C
1133	How should they be paginated (see pagination 3 121) What should be done when a volume starts in the middle of a page	4c		
1134	What should be done with subheadings in indices. Should they be indented and how (See Runovers 3 135)	4d		
1135	Should a standard terminology be developed for the characteristics of braille and the rules of format, etc to be used in the indices of manuals and texts dealing with braille Should that which is used in the official code book be the standard	4e		
.114	Appendices			
1141	Where should appendices and materials, which is referred to and needed in the text but which is ordinarily found in the back of the print book, be placed in the braille book - within the volume where the reference is made, at the back of the braille volume, in the last braille volume, or in a supplement	A5		
.11411	Should its location be contingent upon the significance of the material	5a		
.11412	Could such material be classified according to different types Should size or amount of material determine placement	5b		
11413	What should be done if the material is referred to repeatedly throughout the text.	5c		
11414	Could guidelines be developed to indicate how such material should be handled	5d		
115	Glossaries			
1151	Should there be more braille explanatory material in the glossary sections of books	A6		
.12	Formats for page variations			
121	Pagination			
1211	What is the best manner of numbering pages Where and how should the braille and ink page numbers be indicated	IIIB2	IIID1	
.12111	Should page numbering be the same for different types of materials within and across areas	IVB6 biv	D2	
12112	Where on the page would the numbers be most accessible	IIIB2a		

		TF	MU	M & C
12113	Should the ink print page number appear at the top or the bottom of the page with the braille number opposite or adjacent thereto. Should the numbers be on the right hand side of each page	2b		
12114	How should the numbers be indicated when the ink page stops somewhere within the braille page.	IIIB2c		
12115	How should the pages be numbered when an article, e g biography, is inserted between the pages of a text. Could the phrase, "continued on page so and so," be used	2d		
122	Numbered and lettered lines including those which are to be counted or otherwise reckoned and measure numbering.			
1221	Where and how should the numbers be placed, indented, and spaced. Spacing needs to be different for different sized numerals and allowance made for runover indicators	IIIB3a	IIIE1a	IIIB4
1222	How should measures, parallels, and braces be numbered for solo stringed instruments, unbarred music, and choral music		IIIE2, 3,4	
1223	Do some of the designator's need to be accompanied by a transcriber's note		IIIE3	
1224	In the Bible the print numbering practice varies, should a standard practice be developed for Braille.	IIIB3b		
1225	Under what conditions should number and letter signs be used.	3c		Maps IVB
1226	Rules and procedural guidelines for the above need to be clarified and expanded in the code manuals		IIIE1b,2	
123	Page Titling and key and time signatures.			
1231	Where and how on the page should the title of a book and the key and time signature of a score appear - at the top of every page, full spelling or abbreviated, with or without cap signs	IIIB1a, b,c	IIIF1	
1232	How should a change of signatures within a page be indicated		F2	
1233	For the young child could something be devised to indicate which keys are to be played		F4	

	TF	MU	M & C
124 Alignment and juxtaposition of materials (Related to Runovers and Margins)			
1241 When two or more lines are related or, in some way, correspond and unequal designators, expressions, or directions appear at the beginning of the line how should subsequent material be aligned.		IIIA1	IIIB4
1242 Should vertical alignment be different for different types of material and different operations.		A1a,B1, B1c	
1243 When two lines are to be read together and one line is regularly longer than the other should there be a certain way of always ordering or juxtaposing the lines. Should there be exceptions at the elementary level		IIIB1a,b, B4	
1244 When lines of material are to be read together or associated could they be placed on facing pages		B5	
.1245 In the development of mathematical principles could the statement and reason be alternately presented. How should they be designated, divided when runover, and indented.			IIIE2b
.1246 Could the statement and reason of mathematical principles be set up side by side. Should different types of these materials be set up differently			2c
1247 How does the extra space between lines at the elementary level and the use of tracker dots where there are seven or more spaces between symbols affect the reader's ability to vertically and horizontally align the characters.		J,K	
1248 The rules governing the practices of alignment in the code manuals need to be clarified and expanded and more examples given		A1b,2	
125 Runovers, Word and Measure division and Hyphenation (Related to Alignment and Margins)			
1251 Should certain types of material be treated differently regarding division and continuation from one line or page to the next.	IIIC4d	B3,4	A1,3
.1252 Should different functional modes determine where materials are broken and the disposition of the parts, e.g. in music the length of in accord measures, and in math linked and non-linked modes.		C1,a,b	A2a,b
.1253 Could a priority break list be developed. In the code manuals rules governing runovers are inadequate, and, in general, more rules and examples are needed to cover a greater range of situations.		B3b,c,2, 3	A4

		TF	MU	M & C
1254	How should the break be indicated. Does it always need to be indicated. Could the present practice of hyphenating words be eliminated	C	B3a	A4,b
1255	Where should the continuation sign be placed in relation to the break - after, before the resumption of the material, or in both places			IIIA4c,d
1256	Does use of the hyphen save much space. Does its use affect readability. The hyphen is not used in the literary braille computer translation program	IIIC4a. b,c		4b
1257	When a division is made at a sign of operation, where should the sign of operation appear - at the end of the line, at the beginning of the next line, or at both places			4a
1258	Should division of materials and indicators thereof be handled differently for children in the lower grades			4e
126	Margins (Related to Runovers)			
1261	Often more symbols per line or a line wider spaced than what is currently used is needed. Could the publishing houses produce a 40 or 41 cell line since the current standard of 38 is primarily a convention.			Com IIIB6
1262	Should different types of material be treated differently with respect to margins. Could different materials be classified and specifications developed for the different classes.			IIIB1
1263	Is the proposition factual that most braille readers prefer all material flush with the left most margin because it is more accessible and diminishes search time.	III		
1264	Where on the following line should runovers begin. Should they be indented.			B2
1265	Should different types of runovers be marginated differently. What could be done with successive runovers			B3
127	Footnotes, references, marginal information, and glosses			
1271	Could notes be classified as to their kind and function and should they be treated accordingly. Particular attention should be given to the notes of plays.	IIIA3a		
1272	Should their length and number enter into how they are classified.	3b		

		TF	MU	M & C
1273	Where should the notes and glosses be placed - next to word, at end of line, at end of sentence, at end of paragraph, at bottom of page, at end of chapter or section, in back of volume, in back of book, in separate volume. Should they be indented. Should they be separated from the other material by lines of dots.	3d	IIIG2,a,b,c	
1274	Could their classification determine where they are placed	3e		
1275	How can they be referenced or indicated.	3f	G1	
.12751	How can the reader determine which note goes with which indicator - by numbering, by repeating word	f1		
.12752	Under what conditions should the two procedures be used	f11		
.21753	Should there be different indicators for the different types of notes.	f111		
1276	When referencing material should the Arabic numbers be substituted for Roman numerals as the code recommends?	3g		
1277	What should be the order of presentation of footnotes and glosses when both are copious	3h		
.12771	What are the conditions on which the orders are based	h1		
.12772	Where and how should the pages be numbered when the notes or glosses are continued over several pages	h11		
1278	Where and how should the author's initials or other references be placed and indicated when they are found below and to the right of a passage or verse and sometimes preceded by a hyphen or dash	3i		
1279	Are the rules governing the use of footnotes for foreign language (section 5, T F) adequate for all prose material. Clarification of the indication of footnotes is also needed in the manuals	3c	G1	
.128	Transcriber's Notes			
.1281	When transcribers notes and keys are used with displays what should be done about the following: placement, division, indentation, spacing, designation, vocabulary level and differentiation of author's and transcriber's notes			IIID1
.1282	Should there be special symbols indicating a transcribers note			IIID2
.1283	Where should the indicators and notes be placed relative to the material referenced.			D3

		TF	MU	M & C
1284	For the mathematics code a transcriber's grouping symbol dots 6 and 3, has been developed which is placed before and after the note. Is this the best form of indicator that can be devised			D4
1285	In composing notes the grade or developmental level of the vocabulary should be appropriate. Could standardized messages for frequently occurring conditions be developed.			D5
1286	How should transcribers notes be spaced relative to margins and material above and below. Should different types of materials be spaced differently, e g literary vs. exercise material			D6
129	Variant Type Forms and Print Devices for Emphasis			
1291	Different type forms, italics, capitalizations, etc. often are means of emphasizing or distinguishing material in texts; in other cases they are merely commercial artifices. Could a determination be made of the significance of these variant forms. Could the variant forms be classified and treated accordingly.	IIIE1, a		IIIC1 Com IIIA2a, c
12911	In resolving these problems a central consideration should be the differences between working on plastic, paper, and metal.	E1b		
12912	What considerations should be made about this matter with regard to transcribers. They usually delete as much as possible of these contrivances. Should there be conventions for this.	E1c		
1292	Especially in the Mathematics and Computer areas provisions are needed for different print type fonts and different sized type			IIIC2, Com IIIA2b
12921	Could symbols be devised for these items. Should the symbols be standard across areas			IIIC2a,c
12922	Where should these symbols be placed in reference to the material being modified			C2b
12923	When a special braille symbol is used for a special print symbol, should the print symbol be depicted somewhere so the braille reader will know how it appears			c2d

		TF	MU	M & C
.1293	What should be done with italics and the italic sign The Braille Authority has been asked to eliminate this sign	IIIE2		
12931	Its use requires a subjective judgment of what should be emphasized or distinguished	2a		
12932	There is also the matter of when it should be introduced in Braille	2b		
12933	What effect does its use have on the readability of braille	2c		
.12934	Could more meaningful objective conditions for its use be established	2d		
.12935	In the expression of development of special laws, principles, or mathematical formulas made up of different parts should one of the parts be in bold face or italicized type or should some other special indicator be used to delineate and distinguish between them			IIIE2a
.12936	What should be done when a bold face or other type is embedded in another special type such as italic Provisions are needed for this situation			IIIE3
1294	Double caps - In ink print there are three types of caps - should these be represented in braille.	IIIE3		
12941	When should they be used or not used Should some other procedure be used for directing attention to the material	3a		
12942	When a considerable amount of fully capitalized material appears within the text should some symbol other than the double caps before each word be used Could the italics principle be used.	3b		
12943	How much space should be saved for varying amounts of material using double caps as opposed to a symbol preceding the capitalized material	3c		
1295	Underscoring. What is the best method - dots or smooth line	IIIE4		
12951	Should spacing between underline and material be considered. What is the optimum spacing between the line and the material above and below.	4a		
.12952	Is there a grade level factor involved which is related to spacing.	4b		
12953	Should italics be used instead of underline. Under what conditions should the italics sign be used. When should the switch be made.	4c		

		TF	MU	M & C
1296	Paragraph headings - material on headings needs review and clarification	IIIE5		
12961	Have too many distinctions and provision been made for the different forms of headings, sub-headings, etc. Could this matter be simplified.	5a		
12962	Should a line be skipped before a heading to emphasize change in topic	5b		
12963	Could the differentiae for the various types of headings be specified. Should the treatment of these types be standardized or only kept consistent within a text	5c		
1297	Colored type -its use is on the increase considerably	IIIE6		
12971	What should be done with colored print - should it be coded, or boxed or underlined, etc.	6a		
12972	Should a judgment be made about whether the material is meaningful or referenced in the text or whether it is merely for eye appeal, and then treated accordingly.	6b		
19273	What should be done with colored sections of books	6c		
12974	What should be done when different shadings of colors are used for different purposes.	6d		
12975	Should different constructions be developed for different situations - could these situations be listed.	6e		
1298	Miscellaneous designata - arrows, overlines, numbers			
12981	Where and how should arrows be placed that point to words or different parts of words. Could different situations be determined for which different conditions or practices could be devised	IIIE7,a, b		
12982	How should line segment designations be treated. Could a row of dots 3 and 6 placed above the material be used to designate the segment.			IIIE4
12983	For figured bass and chord analysis in music and other materials where numbers appear under a symbol what is the best way of presenting. Rules and symbols are needed for this material.		IIIL2a,b	
129831	Is interval interpretation easier when represented by numbers		2c	
129832	For reading intervals the current code symbols are in contradiction with print and with the logical ordering in harmonic constructions. Could better alternatives be developed		2d	

	TF	MU	M & C
13 Formats for Language and Special Materials			
131 systems of pronunciation, pronunciation marks, and puncutation	IIIC		
1311 In the 1970 addendum to the Braille Format and Techniques manual diacritical notations has been worked out for five new dictionaries - Webster, New World 1970, American Heritage, Random House. Funk & Wagnal, and Scott-Foresman Should these systems be evaluated	IIIC1		
1312 What is the purpose of having three types of stress signs Are they all needed.	C2		
13121 How do these signs affect the readability of words	2a		
13122 Is there a grade level factor involved in their introduction and use	2b		
13123 The conditions for using these signs needs to be clarified and specified more rigidly	2c		
1313 What should be done with diacritic markings appearing in spelling books which are different from those provided in the code. Mark according to and referencing new code revisions.	C3		
13131 Should special signs be provided and noted.	3a		
13132 Should ones from the code be used	3b		
13133 Should special symbols be delineated in a standard way	3c		
13134 Occasionally phonetic and diacritic signs are used together which means that the same signs having different meanings are being used in the same word	3d		
131341 The braille phonetic code conflicts with braille accented letter signs of foreign languages - could this situation be remedied.	3g1		
131342 Would the use of a special indicator resolve this problem	3d1		
131343 Could warning statements or notes be used to differentiate or specify the different systems that are used and how they are used.	3d11		
132 Plays			
1321 A standard method of representing should be devised Should the standard method be related to the type of play	IIIDla		

		TF	MU	M & C
1322	What would be the best way of differentiating actors parts, stage directions, and stage settings.	1b		
13221	How should the different actors parts be represented. How should it be indicated that a second speaker is to complete a line.	b1		
13222	How should stage directions and settings be represented. Where and how should they be placed. How should they be designated.	b11		
13223	Where should notes be placed relative to their reference. How should this situation be treated where the notes are copious. (See III A 2)	b111		
.133	Poetry			
1331	What is the best way of presenting poetry. Should a standard method be devised.	D2a		
13311	What should be done with poems having unusual formats, e g. shaped like a tree, or the work of E E Cummings.	ai		
13312	If the print format is not followed how could the appearance or structure of the poem be indicated to the reader. Is it necessary to show this.	a11		
13313	Should a transcriber's note be used describing the structure of the poem.	a111		
.134	Foreign Languages			
.1341	All languages for which braille notation is available need study of their symbology and its use. Review should be made of M. Loomis' Standard English Braille in 20 Lessons, 1947, for her treatment of accent and diaeresis signs in foreign languages.	D3a		
.1342	Transcribers should be consulted about foreign languages because there are differences among them in the way they treat ambiguous or problem situations.	3b		
.1343	In print language texts much of the material is presented spatially - how should it be done in braille. Some guidelines for certain braille representations can be found in the grammar section of the Textbook Code and need to be cross-referenced.	3c		
.1344	Should notation and rules be developed for languages for which provisions are not presently available, e g. Portugese.	3d		
.1345	In developing material for foreign languages it should be kept in mind that the transcriber doesn't necessarily know the language with which he is working.	3e		

		TF	MU	M & C
.1346	It is the attitude of many that English braille and foreign language braille should be kept separate, i.e., special provisions for each	3f		
.13461	In changing or shifting from English to a foreign language, e g in a grammar book, there is nothing to indicate the change, which situation is confusing to the reader	fi		
.13462	Should some symbol be used for this purpose. Could the italics sign be used to show the change of language If so, what should be done with material that is already in italics	fii		
.13463	More provisions on the use of italics in these situations are needed in the TF manual	fiii		
.1347	For the transcription of foreign words, braille grade 1 is used while the other characters represent accent and sounds	3g		
.13471	How should inflections within and between words be represented in foreign language transcription. For rules on inflection between words the foreign language section of the TF manual needs to be cross referenced with the speech instruction section	3gii		
.13472	Should the slash, which ordinarily has no space on either side, be accompanied by spaces if it appears so in print In Spanish and Italian the sign for the slash also represents the vowel sound i acute. Could the dash be used instead of the slash symbol	giii		
.13473	In foreign languages italicized vowels mean that the vowel is stressed, however the s also is frequently italicized which indicates it carries the "z" sound How should these items be represented in braille where there is a special sign for stress and a sign for italics	giv		
.13474	In Italian acute symbols for the vowels are needed.	gv		
.13475	When the text or main part is in one language and a footnote or reference is in another should the accent signs differ for the same word in the different languages	gvi		
.1348	The diaresis ¨ in French Textbook Format allegedly is confused frequently with the macron ¯ What could be done to eliminate this confusion	3h		
.1349	When most of the words of a sentence are in English what should be done when to, into, or by comes before a foreign word. Should these prepositions be contracted or written out and should they be placed adjacent to the foreign word.	3i		

		TF	MU	M & C
1350	In German only the first letter of nouns is capitalized and the double cap sign is not used - capitalization serves as an earmark. When following the rules for titles and using double caps, what should be done to distinguish word capitalized within the title	3j		
1351	In the TF manual could the words "in the entry" be inserted after "used" in the first line and the colon and definition be added to the examples to clarify that item.	3k		
1352	On the title page of foreign language books the title uses the special symbols of the language, but the rest of the information - author, publisher, etc. - is in English. Is this a desirable practice - how should the title page items appear	31		
1353	In Spanish the opening and closing conversation signs are confusing. In print it is a dash. The braille sign misleads the student and violates the braille rules when used adjacent to a period. What should this sign be? Could it be a dash the same as in print. A rule is needed specifying that the Spanish custom of not using a closing conversation sign should be observed by transcribers.	3m		
1354	In foreign language should the division of words and hyphenation be treated differently from the practice of English braille. To what extent should the foreign language format be followed compared with that of English braille	3n		

2 Linear Displays

21 General

211 The problems with displays in all areas are similar and are reducible to the more basic matter of making two and three dimensional print figures tactually meaningful. Even so, within certain areas some figures occur with greater and lesser frequency. Should these figures be classified and separate provisions made for each of the areas. — Com IIIC1

212 This whole area needs considerable study which should result in the development of principles governing the representation of displays. A useful starting point may be a survey of transcribers to determine what principles they use, principles which may be intuitive or have been passed along as folklore. These guides used by transcribers should be defined and investigated. — IVA2 Maps IJ

	TF	MU	M & C
213 Many types of print displays either cannot be reproduced in an embossed form or are represented in some other than the original form.	IVB1		Com IIIC1a
2131 Could more readable and more isomorphic representations be developed for these displays			Com IIIC1a,c
2132 Is knowledge of the visual, spatial arrangement necessary for the reader to achieve understanding and comprehension of the concepts involved.			IVB4
2133 Should the form of presentation depend on the type of material represented.			IVD2
2134 What considerations should be made regarding transcribers and displays they are unable to reproduce.	IVB1		
214 What considerations should be made regarding the representation of displays from the standpoint of education and grade level of the reader	B4		IVB3,D8
2141 What concepts are involved and should be taught to children to enable them to read displays	A2e		
2142 Should an investigation be made of the social-emotional factors related to having materials similar to sighted peers	B5		
215 Efforts made in this area should consider the changing nature of displays, new publishing techniques which are replacing the traditional standard forms, and those changes coincident with the use of computers in processing forms	A1b, C1a		
216 Should an instructional manual containing standardized guidelines be developed for displays.	C4		A9
2161 Should the guidelines vary for the different types of production, one-sided vs two-sided or single vs multi-copy			A4
2162 How complete should the guidelines be in covering the various instances of different types of displays.	D3		F3,6,G6c
217 Could a standardized set of tools be developed for the construction of displays and symbols within the displays Could the tools be the same for the different types of production	IIIC3		IVA4,8
22 Types of displays and their placement.			
221 There are many types of displays needing considerable research and development. Among them are those specified alphabetically			

	TF	MU	M & C
below. This listing is not exhaustive; merely ones mentioned by the committees for which particular problems existed. Algorithms, Business forms, Commercie schedules, Determinants and Matrices, Diagrams, Exercises, Family trees, Flow charts, Graphs, Math expressions in general, Outlines, Punch cards, Tables, Test materials, Time lines, Tree diagrams	IVA1,3, C1,3		IIIE1, IVF,2
.222 Could different kinds of these displays be classified possibly on the basis of different variables, and their classification determine how they are treated.	A2aii, iii,3a, i,ii, C1b		IVB1,2, F1
.223 What is the most readable form or arrangement for presenting these displays and different kinds of these displays	A2a,D1, E,F		C1,D1,E1 Com IIIC1b
.2231 Where should the displays be placed on the page. Is there an optimum position on the page where the displays should be located.	D1		IVD3
.2232 Where should the displays be placed in relation to other material on the page.			F8
.2233 How should data accompanying displays be arranged with respect to the display			F4,a,b, H3
.2234 What should be done when the display is too large to fit on a single page or the display runs across a number of pages.	IVA1a1, 2b,C2		
.224 In the production of these displays should a standard method be developed. Is a standard method possible for the different types of media (paper and plastic) and the different production processes (braillewriter, thermoform, and press).			Com IIIC2
.23 Modification and alteration of displays			
.231 In some displays certain operations or relationships between elements are essential to the information conveyed, and are difficult or misleading to represent in braille. How can these displays be represented.	F,1,2		IVC1a,b,H Com IIIC1c,d

	TF	MU	M & C
.232 What should be done with displays which are difficult or impossible to represent in their original format.	E		IVD7,G4, G5bi,ii,6, 6a
.2321 How should they be arranged on the page.	A2ai		
.2322 Under what conditions should certain elements of some displays be transposed.			F
.2323 Should the size or length of the material determine the arrangement.			G6b
.2324 Could standard methods be devised for different types of these displays.	E1		G4
.233 What should be done for certain displays in which the instructions are separated from the examples and exercises			G1a,3b
.234 What should be done with displays, such as pictures, which cannot be represented tactually	IVB3		
.2341 If the pictures involve certain functions or activities related to the text should they be described. Could their educational or informational value be maintained in a description Could common functions be classified and guidelines developed for their disposition.	B3a,b,c, e		
.2342 Should simple embossed pictures or symbols be developed to represent frequently occurring objects or shapes.	B2		
.2343 If the picture cannot be represented what should be done with the caption.	B6,a,b,i		
.24 Titles, Headings.			
.241 Should the title of the material be placed on every page, and where should it appear.	B6bii		
.242 Where should the title of a table be placed with respect to the table - above, below, in both places, at the bottom of the page, centered or left-justified.			IVF7a
.243 Should the treatment of the titles depend on their length.	A2c		
.244 Where and how should columnar heading be indicated. In large tables where columns are repeated do the headings need to be repeated.	A2c		F5c
.25 Designators, Indicators.			
.251 Where and how should displays be numbered or otherwise designated.			IVF7

		TF	MU	M & C
.252	What is the most readable manner of numbering or designating different types of material such as columnar material, test material, exercises, and answers.	IVA3b,i		G5,b,6
.2521	Under what conditions should different types of material be labeled horizontally and vertically.			G5bi,6a
.2522	Where should the indicators be in relation to the left-most and functional margins.			G5a
.253	Within some displays certain relationships or reference points are importnat to information depicted How can these points be indicated.	E2,3		
.254	For displays divided and runover or extended how should the division be indicated.	F5b		C3c,D6b
.255	In the math area is the transcriber's enlarged grouping symbol sufficient for delineating explanatory, subordinate, accompanying material.			C4c
.256	What is the most readable manner of presenting arrows, lead lines, tracker or tracer lines vertical and horizontal cancellation, cancellation of whole rows and whole columns, horizontal, vertical and diagonal ellipsis, etc.			B3,b,D5, E2c,d,i,ii, e,F11
.2561	How much of this material is meaningful to the braille reader.			B3a
.2562	Where should this material be located with respect to what it is modifying.			B3c
.257	When researching this material consideration should be given to the question of similarity of designations for public school blind children and the sighted child and teacher.			A3bii
.26	Spacing			
.261	In spacing between groups and before a topical heading in outlines, between instructions and exercises, table number and title, and above and below a math expression or formula, should a line be skipped before, after, or both.	IVA1aii		IVB3d,C6, F7b, G1a
.262	In tables what is the optimum spacing between columns and between headings and rows			F10
.263	How should the material be spaced relative to process words in equations, viz. therefore, thus, since, and, but, etc			B3e

	TF	MU	M & C
264 Should spacing vary depending on the grade or developmental level of the reader.			B3f,F10
27 Alignment			
271 How should the steps and operations of algorithms and successive terms of equations be aligned.			C2,D4
2711 Should different kinds of these materials be treated differently.			C2a
2712 What should be done when parts or terms within the material are larger than other terms with which they are aligned and/or compared.			D4
2713 Should mathematical material be aligned on the equals sign or could some other form be developed. Does alignment on the equals sign have any mathematical significance.			C2,b,i
27131 What should be done where expansion represents steps of an operation, e g the evaluation of exponents.			C2bii
27132 What should be done when the left hand terms of an equation remain the same.			C2biii
27133 Where should the equals sign or any sign of comparison appear with respect to links ending or beginning a line.			C3d
272 Some displays require the comparison of values or elements with other referents. How can these elements be aligned for optimum comparison			H1,2
28 Margins, Indentation.			
281 For outlies, tabular, and test materials is the present form of successively indenting each subunit two spaces and bringing runovers to the margin the most readable.	IVA1a		
282 In the case of a number of exercises, each with its own instructions should one or the other be indented			G1,b
283 Should long paragraphs within exercises be indented beyond the functional margin. In what cell should they begin			G2a
284 For numbered or lettered material how far should the functional margin be from the designators.			G5a
29 Runovers, Division of Material.			
291 Where and how should large tables, arrays, problems, exercises, and test materials be divided or segmented within and across pages.	IVA2b1, 3c		IVD6,E3, a,F3,F5, a

		TF	MU	M & C
2911	Should different kinds of these materials be treated differently			D6a
2912	For test materials should questions and answers be separated across pages.	A3c1		
2913	What should be done with exercises which are word problems.			G3a
292	What should be done with runovers in these materials and in long titles, exercises, and long paragraphs within exercises			F7c,G1c, G2b
293	How should runovers of table entries be treated Spacing would be a factor in this situation.			F13
294	Presently, there are two ways of treating runovers of entries in determinants and matrices - (1) left justified with line skipped below and (2) indented with no space below Is only one method needed. If so, which is the best; if not, could conditions of use be specified for each method.			E2b
295	How should runovers in formulas and equations be treated.			C3
2951	Where and how should a division in equations be made			C3a
2952	Should the number and size of links influence how they are divided			C3b
2953	Should the extent of formulas or equations affect how they are handled			C1c
300	References, Footnotes			
3001	How should the following types of materials be referenced: explanatory, subordinate, accompanying materials; footnotes within tables, and formulas	IVA2d		C4b,C5 F14
3002	Should there be a standard form for referencing these materials regardless of the print format.			C5
310	Enclosures, Explanatory Material, Entries			
3101	What should be done with such things as boxed and circled material; reduced-type, multi-lined, subordinate or explanatory materials or formulas, and embedded or isolated materials and formulas.	IVC2a		IVB3 C1d,C4
31011	Where should this material be placed in relation to that which it accompanys or modifys			C4a,f
31012	Should different kinds of these materials be treated differently			C4d

		TF	MU	M & C
31013	Should boxed or circled material be enclosed			C43
310131	Could some of the enclosing or grouping symbols be drawn in rather than using the braille configurations			E3c
310132	What would be the best symbols for drawing			E3c
3102	How should entries and other signs of operation within different kinds of arrays be treated			E2,e
31021	Is the present form of left-justifying all entries the most readable and does it adequately cover all conditions			E2a
31022	Could the enclosed material be keyed for the information it contains			C4e
3103	Should the practice of using single and double print lines to separate and distinguish parts or sections of tables be followed when using braille lines Do the lines have a meaningful function besides that of esthetic appeal Is their meaning the same in the tactual mode			IVF9
320	Techniques and Miscellaneous.			
3201	For different types of materials and displays could facing pages be used	IVA2bii, A3cii, C2d,D1a		A5,B3h F5d
32011	Could conditions be determined under which facing pages should or could be used advantageously.			A5b
32012	Could new, more efficient techniques be developed for setting-up and using facing pages.			A5a
3202	Could different representation techniques such as the "skeleton" procedure and the "building" technique be further developed for handling displays.	C2c		A6
3203	Could keying techniques be developed for different types of displays and for different purposes.	A2ci C2b,D1b		A7 E3b
3204	Should different types of lines be developed for different figures and diagrams or parts of diagrams	D2		
3205	What would be the optimum size of books when pictures are deleted and there are only one or two words per page	B6biii		
3206	What should be done with the various ways of marking answers to tests, exercises, etc.	A3aii(A), (B)		
32061	Where should answers be placed, especially when they appear at the back of books or supplements			G6d

		TF	MU	M & C
320611	Should they be placed at the end of the exercises or the volume in which they occur			G6di
320612	Should a note accompany the exercises telling where the answers are located.			G6dii
4 0	Non-linear displays (Maps, charts, diagrams) The problems in this area are less related to codes and line-types of figures and cannot be tied-in well with these problems. Moreover, they require more basic kinds of tactual perceptual research. Hence, they will be treated intact and separately. The specific problems of this area can be found in the section dealing with the outcomes of the area committee meetings attached to this report. The ones most relevant to work on the braille codes are in sections I', III, IV, VI and some of VII.			
5.0	Factors Needing Development			
.1	Complete codes			
.10	The development of complete codes are needed for the following areas: Astronomy, Biology, Botany, Chemistry, Computer, Physics, Logic, Medicine, Statistics and Zoology	VIa1,B1		VB2
.101	Should those codes which are nearly completed, viz. Chemistry and Computer, be evaluated for their notation, format, and rules.			B1
.102	To what extent should codes be developed for the manifold areas of study - numerous new fields of study and endeavor are continuously unfolding. Could some conditions or specifications determine what areas should be encoded in braille.			B3
.2	Symbology, Format, and Rules.			
.20	Symbology and rules need to be developed for Linguistics, different code systems, e.g. Morse and semophore, cooking, and different handicaratts, e.g. sewing, knitting, weaving, etc.	D1,G1 H2,I		
.21	Formating procedures and rules need to be developed for recipes in cooking, and certain of the handicrafts. Should these formats be standardized.	VIH1,I		
.3	Displays.			

		TF	MU	M & C
.30	Procedures and rules for linear displays need to be developed for the areas of Money and Commerce and different types of puzzles and games	E1,G2		
.31	Procedures and rules for non-linear displays need to be developed for some of the puzzles and games and the areas of Geography and Geology	C1,G2		
.4	Special factors needing development			
.40	Biblical reference symbols.			
.401	Most of the problems have to do with the vagaries of numbering found in the different editions of the Bible and how they should be treated in braille.	F1		
.402	Should a standard numbering system be developed for all biblical references	F2		
.403	Should the biblical reference symbols currently used be evaluated.	F3		
.5	Music materials needing development			
.50	There are quite a few items needing development in the area of braille music. They come under two categories - (1) development of different types of music and materials, and (2) developments for different instruments. They are listed in the results of the Music Committee Meeting, and will not be repeated here.		IVB,C	

6.0 Resources

Persons, organizations, and materials which would be useful in resolving the aforementioned problems are listed at the back of the reports for each of the separate committee meetings. Foremost among persons competent to deal with problems of the codes are those who served as active committee members in each of the areas. These sources will not be repeated in this section.

Appendix E

Two Reviewers' Judgments of Methodology* and Time for Resolving the Generalized Problem Items

	A	B
1.0 General Considerations		
.111	GJ,1	GJ,1
.1111	GJ,1	GJ,OS,1
.1112	GJ,1	GJ,1
.1113	GJ,1	GJ,1
.112	GJ,1	GJ,1
.113	GJ,1	GJ,1
.114	ER,1	GJ,ER,1
.121	ER,2	ER,2
.1211	ER,2	ER,2
.1212	ER,2	ER,2
.1213	ER,2	ER,2
.122	ER,2	ER,2
.1221	ER,2	ER,2
.1222	ER,2	ER,2
.123	CD,2	GJ,2
.124	CD,2	GJ,LA,2
.125	CD,2	GJ,1
.126	CD,2	GJ,1
.127	CD,2	GJ,2
.131	CD,2	GJ,LA,1
.132	CD,1	GJ,1
.133	GJ,2	GJ,1
.1331	GJ,2	GJ,2
.1332	GJ,2	GJ,2
.134	GJ,2	GJ,1
.135	ER,2	GJ,ER,2
.1351	ER,2	GJ,ER,2
.1352	ER,1	GJ,LA,1
.1353	GJ,1	GJ,1
.136	GJ,1	GJ,ER,1
.137	CD,2	CD,2
.138	CD,2	CD,2
.141	GJ,1	GJ,1
.142	GJ,1	GJ,1
.1421	GJ,1	GJ,OS,1
.1422	GJ,1	GJ,OS,1
.1423	GJ,1	GJ,1
.143	ER,2	GJ,ER,1

* The evaluation consisted of three basic methodologies, GJ - Group Judgment or Consensus, ER - Experimental or Empirical Research, and CD - Code Development, and two time estimates, (1) Short term activity of less than three years, and (2) long term efforts requiring more than three years. Reviewer B, while using the three basic approaches, attempted to elaborate the evaluation by combining the methods and adding two others. LA - Literature Analysis, which can be a review or analysis of the braille and/or print literature or a frequency count of elements of the language, and OS - an Opinion Survey. This latter evaluation will be used for subsequent tabulations.

	A	B
.151	GJ,1	GJ,1
.152	GJ,1	GJ,1
.1521	GJ,1	GJ,1
.1522	ER,1	GJ,LA,1
.1523	GJ,1	GJ,1
.153	GJ,2	GJ,2
.1531	ER,2	ER,2
.1532	GJ,2	ER,2
.1533	GJ,1	ER,2
.1534	GJ,1	GJ,1
.154	GJ,1	GJ,OS,1
.161	CD,2	GJ,1
.162	CD,2	GJ,1
.163	CD,2	GJ,CD,1
.164	GJ,2	GJ,1
.1641	GJ,2	GJ,1
.16411	GJ,2	GJ,1
.16412	GJ,2	GJ,1
.1642	GJ,1	GJ,1
.1643	GJ,2	GJ,LA,1
.1644	GJ,2	GJ,1
.171	GJ,1	GJ,LA,1
.1711	GJ,1	GJ,1
.1712	ER,1	GJ,LA,1
.1713	GJ,1	GJ,OS,1
.172	GJ,1	GJ,LA,1
.173	GJ,2	GJ,ER,2
.174	GJ,1	GJ,LA,OS,1
.18	GJ,2	GJ,2
.181	GJ,1	GJ,1
.1811	GJ,1	GJ,1
.1812	GJ,1	GJ,2
.1813	GJ,1	GJ,1
.1814	GJ,2	GJ,2
.182	CD,2	CD,2
.183	CD,1	GJ,1
.1911	CD,2	GJ,1
.19111	CD,2	GJ,1
.19112	CD,2	GJ,1
.1912	CD,2	CD,2
.1913	CD,2	GJ,CD,2
.19131	CD,2	GJ,1
.19132	CD,2	GJ,1
.191321	CD,2	GJ,1
.191322	CD,2	GJ,1
.191323	CD,2	GJ,1
.191324	ER,2	GJ,ER,2
.1914	ER,2	GJ,ER,1
.1915	GJ,1	GJ,1
.1921	ER,2	GJ,ER,2
.1922	GJ,1	GJ,OS,1
.1923	ER,2	GJ,ER,2
.1924	ER,2	GJ,ER,2
.1925	ER,2	ER,2
.1926	ER,1	GJ,1
.211	GJ,1	GJ,1
.221	GJ,1	GJ,1
.2211	ER,2	GJ,ER,1
.2212	ER,GJ,2	GJ,ER,2
.222	CD,1	GJ,1
.223	GJ,1	GJ,1
.224	GJ,1	GJ,1
.231	GJ,1	GJ,ER,1
.232	GJ,1	GJ,1
.233	GJ,1	GJ,1
2331	GJ,1	GJ,1
.2332	ER,1	GJ,ER,1
.23321	GJ,1	GJ,ER,1
.23322	GJ,1	GJ,1
.234	GJ,1	GJ,1
.2341	ER,1	GJ,ER,1
2342	GJ,1	GJ,1
.235	CD,2	GJ,1
.236	CD,2	GJ,1
.241	CD,2	GJ,CD,1
242	CD,2	GJ,CD,1
.243	CD,2	GJ,1
.244	GJ,2	GJ,1
.245	GJ,2	GJ,1
.2451	GJ,2	GJ,LA,1
.2452	GJ,1	GJ,1
.2453	GJ,1	GJ,1
.246	CD,2	GJ,LA,1
.251	ER,2	GJ,ER,2
.252	GJ,1	GJ,1
.253	GJ,1	GJ,ER,2
.254	ER,2	ER,2

	A	B
2 0 Problems of Symbols and Rules		
1	GJ,2	GJ,LA,2
11	GJ,2	GJ,LA,1
12	GJ,2	GJ,1
13	GJ,2	GJ,1
14	ER,1	GJ,ER,1
15	GJ,1	GJ,1
16	GJ,1	GJ,LA,1
17	GJ,1	GJ,1
18	GJ,1	GJ,1
19	CD,2	GJ,ER,1
20	CD,2	GJ,1
21	CD,2	GJ,1
22	CD,2	GJ,1
23	ER,2	ER,2
24	GJ,1	GJ,LA,1
25	GJ,1	GJ,OS,1
26	GJ,1	GJ,1
27	ER,2	GJ,ER,2
3	CD,2	GJ,1
31	GJ,1	GJ,1
32	GJ,1	GJ,1
33	GJ,1	GJ,1
34	GJ,1	GJ,LA,1
35	ER,1	GJ,LA,1
4	GJ,2	GJ,ER,2
41	ER,2	ER,2
42	GJ,2	GJ,1
43	GJ,2	GJ,1
44	GJ,1	GJ,ER,1
45	ER,2	GJ,ER,1
46	ER,2	GJ,ER,1
47	ER,2	GJ,ER,1
5	CD,2	GJ,CD,1
51	CD,1	GJ,ER,1
52	GJ,1	GJ,1
53	GJ,1	GJ,1
3 0 Formats and Linear Displays		
1 Formats		
1111	GJ,ER,1	GJ,ER,1
1112	ER,1	ER,1
1113	GJ,1	GJ,1
1114	GJ,1	GJ,1
1121	GJ,ER,1	GJ,ER,OS,1
1122	GJ,1	GJ,1
1131	ER,1	ER,OS,1
1132	GJ,1	GJ,ER,OS,1
1133	GJ,1	GJ,ER,1
1134	ER,1	ER,OS,1
1135	GJ,1	GJ,1
1141	GJ,ER,1	GJ,OS,1
11411	GJ,1	GJ,1
11412	GJ,1	GJ,LA,1
11413	GJ,1	GJ,1
11414	GJ,1	GJ,1
1151	GJ,1	GJ,OS,1
1211	GJ,1	GJ,ER,OS,1
12111	GJ,1	GJ,LA,1
12112	ER,1	ER,1
12113	GJ,1	ER,OS,1
12114	GJ,1	ER,OS,1
12115	GJ,1	GJ,OS,1
1221	GJ,ER,1	GJ,ER,1
1222	GJ,1	GJ,ER,1
1223	GJ,1	GJ,1
1224	GJ,1	GJ,1
1225	GJ,2	GJ,LA,1
1226	GJ,2	GJ,1
1231	GJ,1	GJ,ER,1
1232	GJ,1	GJ,1
1233	GJ,1	GJ,1
1241	GJ,1	GJ,ER,1
1242	GJ,1	ER,LA,1
1243	GJ,1	GJ,ER,1
1244	GJ,1	ER,OS,1
1245	GJ,1	GJ,ER,1
1246	GJ,1	GJ,LA,1
1247	ER,1	ER,1
1248	GJ,1	GJ,LA,1
1251	GJ,1	GJ,ER,LA,1
1252	GJ,ER,2	GJ,LA,1
1253	GJ,ER,2	GJ,LA,1
1254	GJ,1	GJ,1
1255	GJ,1	GJ,ER,1
1256	ER,1	ER,LA,1
1257	GJ,1	GJ,ER,1
1258	GJ,ER,2	GJ,ER,1
1261	GJ,1	GJ,1
1262	GJ,ER,1	GJ,LA,1

	A	B
.1263	ER,1	ER,OS,1
.1264	GJ,ER,1	ER,1
.1265	GJ,1	GJ,ER,LA,1
.1271	GJ,1	GJ,LA,1
.1272	GJ,1	GJ,1
.1273	GJ,1	GJ,ER,1
.1274	GJ,1	GJ,LA,1
.1275	GJ,1	GJ,ER,1
.12751	GJ,1	GJ,ER,OS,1
.12752	GJ,1	GJ,LA,1
.12753	GJ,1	GJ,LA,1
.1276	GJ,1	GJ,1
.1277	GJ,1	GJ,1
.12771	ER,1	GJ,1
.12772	GJ,1	GJ,1
.1278	GJ,1	GJ,1
.1279	GJ,1	GJ,LA,1
.1281	GJ,1	GJ,ER,LA,1
.1282	GJ,1	GJ,1
.1283	GJ,1	GJ,ER,1
.1284	CD,1	GJ,1
.1285	GJ,1	GJ,LA,1
.1286	GJ,1	GJ,ER,1
.1291	GJ,ER,2	GJ,LA,1
.12911	GJ,1	GJ,1
.12912	GJ,1	GJ,OS,1
.1292	CD,2	GJ,LA,1
.12921	CD,2	GJ,1
.12922	GJ,CD,2	GJ,ER,1
.12923	GJ,1	GJ,1
.1293	GJ,1	GJ,OS,1
.12931	GJ,1	GJ,1
.12932	GJ,1	GJ,ER,1
.12933	ER,1	ER,1
.12934	GJ,1	GJ,LA,1
.12935	GJ,1	GJ,1
.12936	GJ,1	GJ,1
.1294	GJ,1	GJ,1
.12941	GJ,1	GJ,1
.12942	GJ,1	GJ,1
.12943	ER,1	GJ,LA,1
.1295	ER,1	ER,1
.12951	ER,1	ER,1
.12952	ER,1	ER,1
.12953	GJ,1	GJ,ER,1
.1296	GJ,1	GJ,1
.12961	GJ,1	GJ,1
.12962	GJ,1	GJ,ER,1
.12963	GJ,1	GJ,LA,1
.1297	GJ,1	GJ,1
.12971	GJ,1	GJ,ER,1
.12972	GJ,1	GJ,1
.12973	GJ,1	GJ,LA,1
.12974	GJ,1	GJ,LA,1
.12975	GJ,1	GJ,LA,1
.12981	GJ,CD,1	GJ,ER,LA,1
.12982	GJ,1	GJ,ER,1
.12983	CD,2	GJ,ER,1
.129831	ER,1	GJ,ER,1
.129832	CD,2	GJ,1
.1311	GJ,1	GJ,1
.1312	GJ,1	GJ,1
.13121	ER,1	ER,1
.13122	ER,1	GJ,ER,1
.13123	GJ,1	GJ,1
.1313	GJ,1	GJ,1
.13131	GJ,1	GJ,1
.13132	GJ,1	GJ,1
.13133	GJ,1	GJ,LA,1
.13134	CD,1	GJ,1
.131341	CD,1	GJ,1
.131342	GJ,1	GJ,1
.131343	GJ,1	GJ,1
.1321	GJ,1	GJ,LA,1
.1322	GJ,1	GJ,ER,1
.13221	GJ,1	GJ,LA,ER,1
.13222	GJ,1	GJ,ER,LA,1
.13223	GJ,1	GJ,ER,1
.1331	GJ,1	GJ,LA,1
.13311	GJ,1	GJ,LA,1
.13312	GJ,1	GJ,1
.13313	GJ,1	GJ,1
.1341	CD,2	GJ,LA,1
.1342	GJ,1	GJ,OS,1
.1343	GJ,1	GJ,LA,ER,1
.1344	CD,2	GJ,CD,2
.1345	CD,2	GJ,1
.1346	GJ,1	GJ,1
.13461	GJ,1	GJ,1
.13462	GJ,1	GJ,1
.13463	GJ,1	GJ,1
.1347	GJ,1	GJ,1
.13471	GJ,1	GJ,LA,1

	A	B
13472	GJ,1	GJ,1
13473	CD,1	GJ,1
13474	CD,1	GJ,1
13475	GJ,1	GJ,1
1348	GJ,1	GJ,1
1349	GJ,1	GJ,1
1350	CD,1	GJ,1
1351	GJ,1	GJ,1
.1352	GJ,1	GJ,OS,1
1353	GJ,1	GJ,1
1354	GJ,1	GJ,1
2 Linear Displays		
211	GJ,ER,2	GJ,ER,LA,2
212	ER,2	ER,OS,1
213	GJ,2	GJ,LA,1
.2131	ER,2	ER,2
2132	ER,1	ER,1
.2133	GJ,ER,1	GJ,LA,1
2134	GJ,1	GJ,1
214	GJ,1	GJ,ER,1
2141	ER,2	GJ,ER,LA,2
2142	ER,1	ER,1
215	GJ,2	GJ,LA,2
.216	GJ,2	GJ,2
.2161	GJ,1	GJ,1
2162	GJ,1	GJ,LA,1
.217	GJ,ER,2	GJ,ER,2
.221	GJ,1	GJ,LA,1
222	ER,2	ER,LA,1
.223	ER,2	ER,2
2231	GJ,ER,1	GJ,ER,1
2232	GJ,1	GJ,ER,1
2233	GJ,1	GJ,ER,1
2234	GJ,1	GJ,ER,1
224	ER,2	GJ,ER,LA,2
231	ER,2	GJ,ER,1
232	GJ,1	GJ,ER,LA,1
2321	GJ,1	GJ,ER,1
.2322	GJ,2	GJ,ER,1
2323	GJ,2	GJ,ER,1
2324	ER,2	GJ,ER,2
233	GJ,1	GJ,OS,LA,1
234	GJ,1	GJ,1
2341	GJ,1	GJ,1
2342	GJ,1	GJ,LA,1
2343	GJ,1	GJ,1

	A	B
.241	GJ,1	GJ,ER,1
242	GJ,1	GJ,ER,1
243	GJ,1	GJ,ER,1
.244	GJ,1	GJ,ER,1
251	GJ,1	GJ,ER,1
252	ER,2	ER,LA,GJ,1
2521	GJ,1	GJ,ER,LA,1
2522	GJ,1	GJ,ER,1
.253	ER,2	ER,2
254	GJ,1	GJ,ER,1
.255	GJ,1	GJ,1
256	ER,2	ER,2
2561	ER,2	ER,2
.2562	ER,2	ER,GJ,2
257	GJ,1	GJ,1
.261	GJ,1	GJ,ER,1
.262	ER,1	ER,1
263	GJ,1	GJ,ER,1
.264	ER,1	ER,1
.271	GJ,1	GJ,ER,1
.2711	GJ,1	GJ,LA,ER,1
2712	GJ,1	GJ,ER,1
2713	GJ,1	GJ,ER,1
27131	GJ,1	GJ,1
.27132	GJ,1	GJ,1
27133	GJ,1	GJ,ER,1
272	GJ,1	GJ,ER,1
.281	ER,1	ER,GJ,1
.282	GJ,1	GJ,ER,1
.283	GJ,1	GJ,ER,1
.284	ER,1	GJ,ER,1
.291	GJ,1	GJ,ER,1
.2911	GJ,1	LA,ER,1
2912	GJ,1	GJ,1
2913	GJ,1	GJ,1
292	GJ,1	GJ,ER,1
.293	GJ,1	ER,1
.294	GJ,ER,1	ER,1
.295	GJ,1	GJ,ER,1
.2951	GJ,1	GJ,ER,1
.2952	GJ,1	GJ,1
.2953	GJ,1	GJ,1

	A	B
3001	GJ,1	GJ,ER,1
3002	GJ,1	GJ,1
3101	GJ,1	GJ,ER,1
31011	GJ,1	GJ,ER,1
31012	GJ,1	GJ,ER,LA,1
31013	GJ,1	GJ,ER,1
310131	GJ,1	GJ,ER,1
310132	ER,1	ER,1
3102	GJ,1	GJ,ER,1
31021	ER,1	ER,LA,1
31022	GJ,1	GJ,1
3103	GJ,1	GJ,ER,1
3201	GJ,1	GJ,ER,OS,1
32011	GJ,1	GJ,ER,1
32012	GJ,2	GJ,ER,1
3202	GJ,2	GJ,ER,1
3203	GJ,2	GJ,ER,LA,1
3204	GJ,ER,2	GJ,ER,LA,1
3205	GJ,ER,1	GJ,OS,1
3206	GJ,ER,1	GJ,ER,1
32061	GJ,1	GJ,1
320611	GJ,1	GJ,1
320612	GJ,1	GJ,1
5 0 Factors Needing Development		
.10	CD,2	CD,2
.101	GJ,1	GJ,ER,CD,1
.102	GJ,2	GJ,1
.20	CD,2	CD,GJ,LA,2
.21	GJ,1	GJ,1
.30	GJ,2	GJ,ER,2
.31	GJ,2	GJ,ER,2
.401	GJ,2	GJ,1
.402	GJ,1	GJ,1
.403	GJ,1	GJ,ER,1

5 Music		B
IV A	1	GJ,1
	2	GJ,1
	3	ER,1
	4a	GJ,1
	b	GJ,1
	c	GJ,OS,1
	5	GJ,1
B	1	GJ,1
	2a	GJ,CD,1
	b	GJ,1
	c	GJ,1
	3a	GJ,CD,1
	b	GJ,1
	c	GJ,CD,1
	d	GJ,1
	e	GJ,1
	f	GJ,1
	g	GJ,1
	4a&b	GJ,CD,1
	5	GJ,1
	6a	GJ,1
	b	GJ,1
	c	GJ,1
	d	GJ,1
	7a	ER,1
	b	GJ,1
	8a	GJ,1
	b	ER,1
	10a	GJ,1
	b	GJ,1
	c	GJ,1